MODEL 6144-28

EPUT & TIMER

Beckman®

# Operating and Servicing Manual

Electronic Instruments Division

# MODEL 6144-28

# EPUT & TIMER

Beckman®

INSTRUMENTS, INC.

ELECTRONIC INSTRUMENTS DIVISION

RICHMOND, CALIFORNIA • 94804

## WARRANTY

Instruments sold by Electronic Instruments Division, Beckman Instruments, Inc., (hereafter called "the Company") are warranted only as stated below.

Subject to the exceptions and upon the conditions specified below, the Company agrees to correct, either by repair, or, at its election, by replacement, any defect of material or workmanship which develops within one year after delivery of the instrument to the original purchaser by the Company or by an authorized representative, provided that investigation and factory inspection by the Company discloses that such defect developed under normal and proper use.

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(f) Representations and warranties made by any person, including representatives of the Company, which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitation of the liability of the Company as set forth above) shall not be binding upon the Company unless reduced to writing and approved by an officer of the Company.

(g) This warranty shall be governed by the laws of the State of California.

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Schiller Park, Illinois 60176

EASTERN

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Electronic Instruments Division
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Mountainside, New Jersey 07091

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Fullerton, California 92634

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Huntsville, Alabama 35801

12050 Tech Road
Montgomery Industrial Park
Silver Springs, Maryland 20904

BECKMAN INSTRUMENTS

6144-28

EPUT & TIMER

The BECKMAN Model 6144-28 is a standard BECKMAN Model 6144 which has been modified as follows:

1) A6-696 BASIC PLUG-IN has been deleted and replaced with a cover plate.

2) A13- Provides relay rack mounting adapters and PC extender boards.

3) Instrument is modified to meet Military specification I 6181 (RFI conduction out power cord).

4) BCD data and print command logic levels have been changed to "1"= +5 volts and "0" = +. 5 volts.

5) Instrument signal ground system is isolated from chassis and power line ground. Signal ground may be floated to a maximum of 200 volts DC. All BNC connectors have been replaced with Automatic 94375 RF 01525 P Triaxial connectors (outer shield connected to power ground and inner shield connected to signal ground).

In all other respects this instrument is standard and the following instruction manual will apply.

NOTE: J9 PIN 33 PRINT COMMAND
J9 PIN 39 " " COMPLEMENTARY
J9 PIN 40 INHIBIT

INVERTER SPEC. XA105

INVERTER SPEC. XA104

INVERTER SPEC. XA103

INVERTER SPEC. -1 XA102

XA33A XA33B

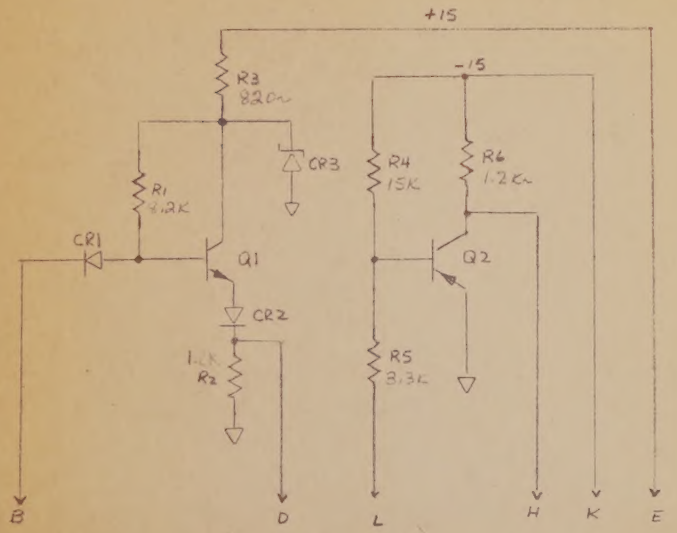
INVERTER SPEC.-2

RESET TO PIN R XA33 (RECYCLE)
DRW D020 416157
DRW D020 416173

⬡ DENOTES CONNECTIONS OF STORAGE BDS TO INVERTORS

6144-28

| B SIZE | DWG. NO | REV | DESCRIPTION | ECO NO | DATE | BY | CHKD | APPD |
|---|---|---|---|---|---|---|---|---|




| ITEM | DESCRIPTION | PART NO | QTY |
|---|---|---|---|
| R1 | 82K. 1/4W 5% | 601-822331 | 1 |
| R2 | 1.2KΩ 1/4W " | 601-822326 | 2 |
| R3 | 820Ω 1/4W " | 601-822306 | 1 |
| R4 | 15KΩ 1/4W " | 601 822301 | 1 |
| R5 | 3.3KΩ 1/4W " | 601 822296 | 1 |
| R6 | SAME AS R2 | | |
| CR1 | BECK SPEC | A 755-402107 | 1 |
| CR2 | BECK SPEC | A 755-431324 | 1 |
| CR3 | DIODE ZENER 5.1V IN751A | 755-818496 | 1 |
| Q1 | TRANSISTOR SILICON 2N1420 | 755-817964 | 1 |
| Q2 | TRANSISTOR SILICON 2N3638 | 755-838105 | 1 |
| | PC BRD INV | B693-42.3436 | 1 |

| NEXT ASSY | USED ON |
|---|---|
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED

TOLERANCES

X ±.050 ANGULAR ±0° 30'
XX ±.020
XXX ±.005 MACH. SURF. ✓

THREADS: CLASS 2A OR 2B
REMOVE BURRS & SHARP EDGES .020 MAX.
MACH. FILLET RADIUS .020 R MAX.
MACH. SURF. FLAT WITHIN .001 IN/IN
OTHER SURF. FLAT WITHIN .005 IN/IN
CONCENTRICITY MACH. SURF. TIR WITHIN ½ SUM OF DIA. TOLS., .001 MIN.

DO NOT SCALE DRAWING

| | BY | DATE |
|---|---|---|
| DRAWN | ERISKIN | |
| CHKD | | |
| ENGR | | |
| APPD | | |
| APPD | | |

| ITEM | PART NO | DESCRIPTION | QTY. |
|---|---|---|---|

TITLE: INVERTER F' FOLLOWER

6144-28/2

MATERIAL

FINISH

SCALE

B SIZE

Beckman® INSTRUMENTS, INC.
ELECTRONIC INSTRUMENTS DIVISION
RICHMOND, CALIFORNIA

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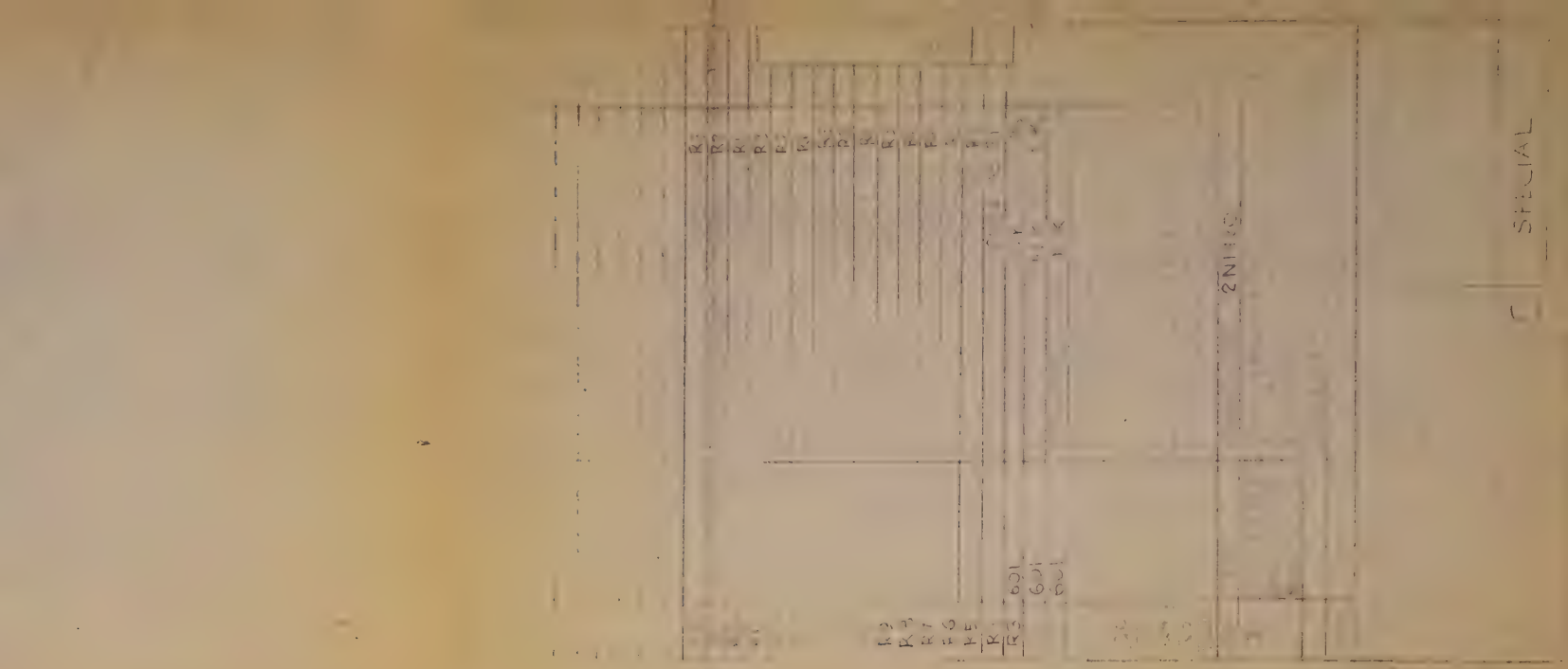
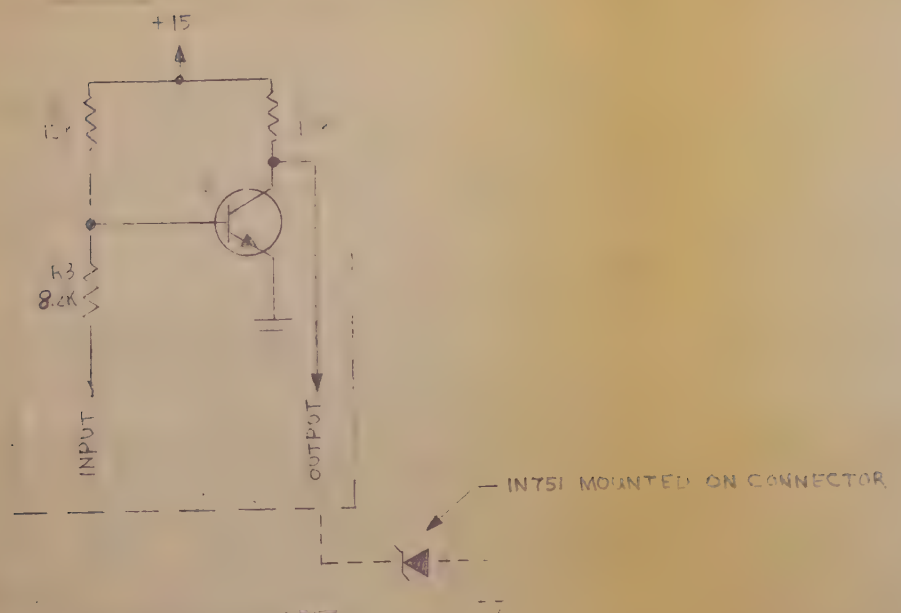
SPECIAL

SHEET OF REV


SPECIAL




) TRANSISTORS 2N1420

Beckman

SPECIAL

# MODEL 6144

## EPUT® & TIMER

(PREFIX 500)

SERIAL NO. 451

Beckman®
INSTRUMENTS, INC.
ELECTRONIC INSTRUMENTS DIVISION
RICHMOND, CALIFORNIA • 94804

September 1963
(Rev. Mar. 1967)

BII No. 015-436079

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# ADDENDUM A

## MODEL 6144

For all EL Supply and Regulator boards stamped with revision letter "K".

1) To take the Power Supply schematic diagram, page 5-14a (drawing number 64D-6100-023-Rev. L) to revision level K, change Q3 and Q4 of EL Supply section (A35) from 2N3638's to 2N404's; and change Q2, Q3, Q5, and Q6 of Regulator section (A34) from 2N3638's to 2N404's.

   Change the schematic revision letter to "Rev. K".

2) Change the EL Supply and Regulator component layouts, page 5-14 (drawing numbers 64B-6100-022-Rev. L and 64B-6100-021-Rev. L, respectively) from "Rev. L" to "Rev. K" to agree with revision letters of actual board assemblies.

3) Change the parts lists for boards A34 and A35 to agree with the following:

| Detail No. | Beckman Stock No. | Description | Typical Mfg. & No. |
|---|---|---|---|
| A34 - Q2, 3, 5, 6 | 755-800398 | Transistor, Germ., PNP, 150 mw max. | Sylvania 2N404 |
| A35 - Q3, 4 | 755-800398 | Transistor, Germ., PNP, 150 mw max. | Sylvania 2N404 |

# MODEL 6144

For all Regulator boards (A412442) stamped with revision letter "L-1":

To bring the schematic diagram (dwg. no. 64D-6100-023-Rev. L) on Page 5-14a up to revision level "L-1" change resistor R22 (part no. 601-015229) to 3.3K, 1W, 5%, part no. 601-800065.

Change the parts list (on the back of Page 5-14) to agree with the above.

# MODEL 6144

For all Regulator boards (A412442) stamped with revision letter "L-2":

Revision L Regulator board has been modified by clipping out resistors R8 and R23 (680Ω, 2W each) and adding a 100K, 1/4W, 10% resistor from the +90V regulated line to ground for boards used in instruments equipped with SCR type DSU boards.

Note that the 680Ω resistor, R8, was located under the Power Supply chassis.

Prefix

# ADDENDUM A-3

## MODEL 6144

For all Regulator Board assemblies stamped with revision letter "M":

There are no differences between assemblies (dwg. no. A412442) and schematics (dwg. no. D411974) stamped with Rev. "M" and Rev. "L-2".

ADDENDUM B

MODEL 6144

For all Time Base Logic boards stamped with revision letter "F":

1) To take the Time Base Logic schematic diagram (drawing no. 64C-6100-008-Rev. G) to revision level F, add R26; change R21 from 2.2K to 10K; change R30 from 820Ω to 2.7K; change R31 from 15K to 10K; change CR3 and 6 from part number 755-420893 to 755-824300 (HD1842): and delete CR12. See figure 1 for "before" and "after" configurations.

   Change the schematic revision letter to "Rev. F".

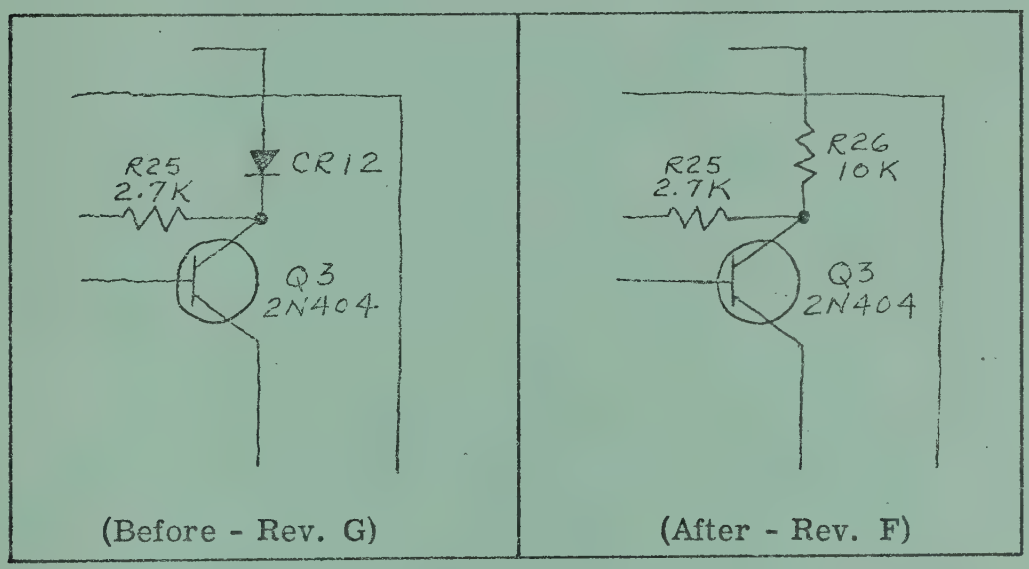



Figure 1

2) To take the Time Base Logic component layout (drawing no. 64B-6100-007-Rev. G) to revision level F, delete CR12 and replace it with R26 as shown in figure 2. Change the component layout revision letter to "Rev. F" to agree with the schematic and actual board revision letter.

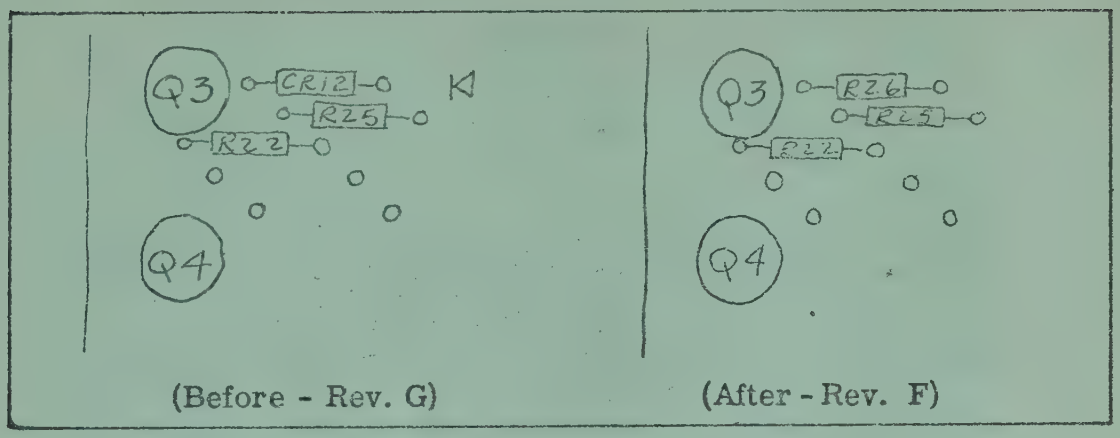



Figure 2

3) Make the following changes to the parts list, located on the back of page 5-11:

| Detail No. | Beckman Stock No. | Description | Typical Mfgr. & No. | Comment |
|---|---|---|---|---|
| R21, 26 | 601-823108 | Resistor, F. Comp., 10K, 1/4W, 10% | A. B. CB1031 | Add |
| R21 | | | | Delete |
| R30 | | | | Delete |
| R30 | 601-822295 | Resistor, F. Comp., 2.7K, 1/4W, 5% | A. B. CB2725 | Add |
| R31 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | A. B. CB1035 | Add |
| R31 | | | | Delete |
| CR12 | | | | Delete |
| CR3, 6 | | | | Delete |
| CR3, 6 | 755-824300 | Diode, Germanium | Hughes HD1842 | Add |

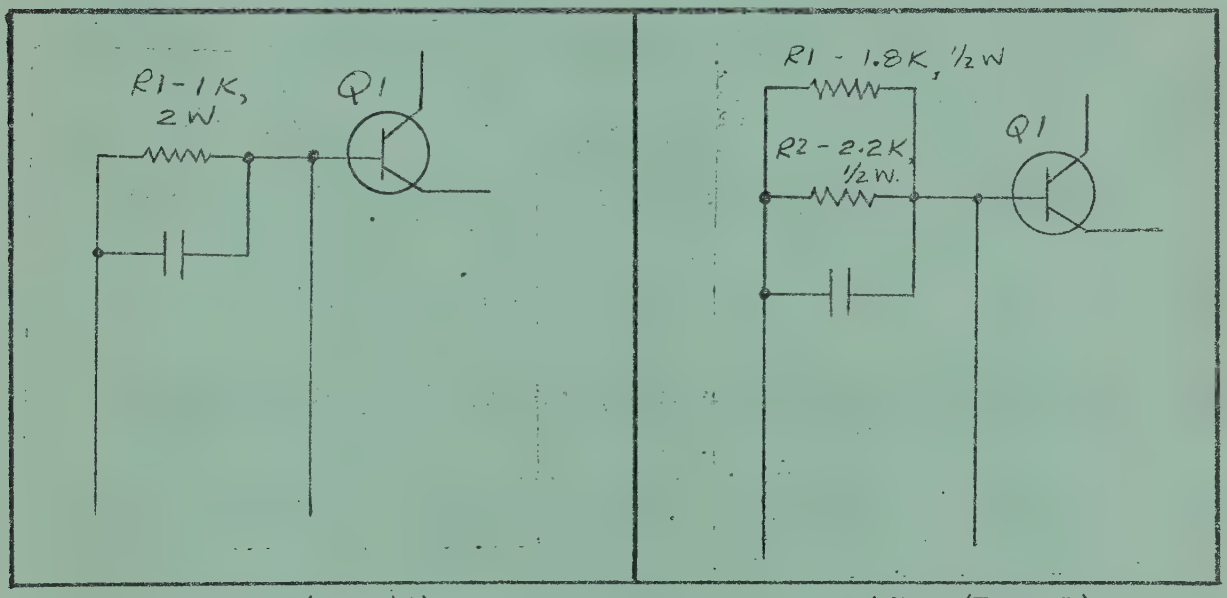
ADDENDUM C

MODEL 6144

For all 2.5 MHz Input Amplifier boards stamped with revision letter "F":

1) To take the 2.5 MHz Input Amplifier schematic diagram, page 5-5a (drawing number C416020-Rev. G) to revision level F, delete R1 (1K, 2W) and replace with a parallel combination of R1 (1.8K, 1/2W) and R2 (2.2K, 1/2W) as shown in Figure 1.

   Change the schematic revision letter to "Rev. F".



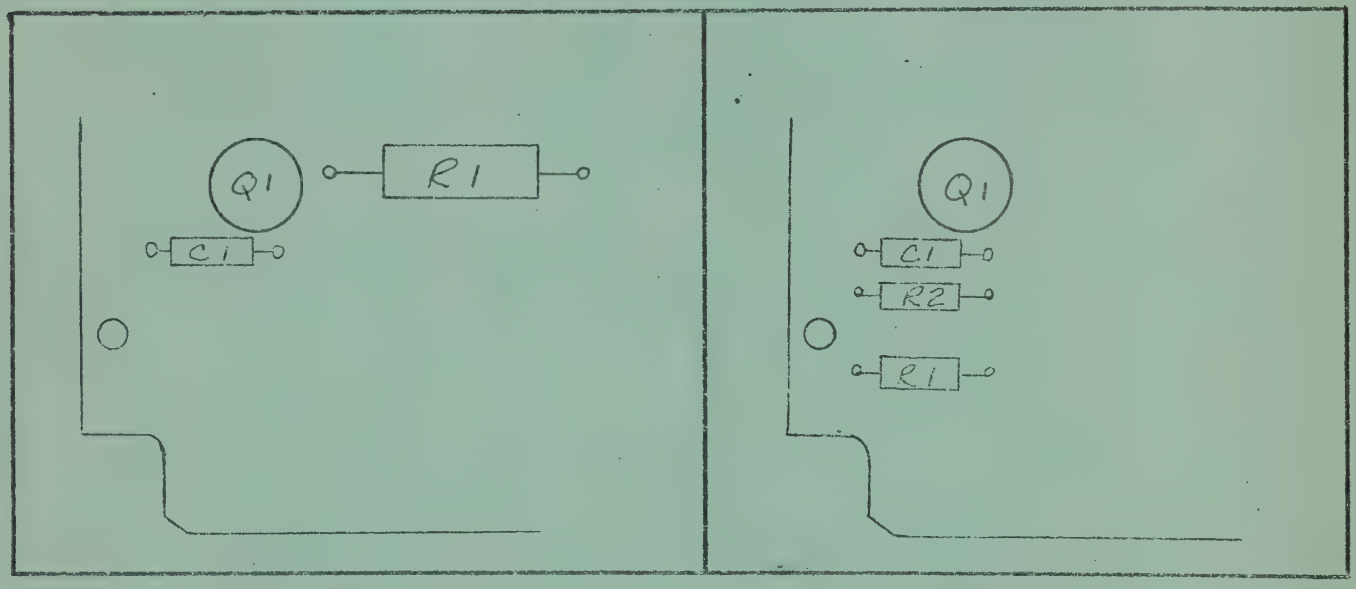

Before (Rev. G) After (Rev. F)

Figure 1.

2) Change the 2.5 MHz Input Amplifier component layout, page 5-5 (drawing number A410929-Rev. G) as shown in Figure 2. Change the component layout revision letter to "Rev. F" to agree with the schematic and actual board revision letter.

3) Make the following changes to the parts list on the back of page 5-5:

| Detail No. | Beckman Stock No. | Description | Typical Mfg. & No. | Comment |
|---|---|---|---|---|
| R1 | | | | Delete |
| R1 | 601-015449 | Resistor, F. Comp., 1.8K, 1/2W, 5% | Allen Bradley EB1825 | Add |
| R2 | 601-000897 | Resistor, F. Comp., 2.2K, 1/2W, 5% | Allen Bradley EB2225 | Add |




Before (Rev. G) After (Rev. F)

Figure 2.

# ADDENDUM C-1

## MODEL 6144

For all 2.5 MHz Input Amplifier boards stamped with revision letter "E":

1) To take the 2.5 MHz Input Amplifier schematic diagram (drawing number C416020-Rev. F) back to revision level E, change Q5 and Q6 from part number 755-419596 to part number 755-819908 (2N834). Delete Note 5 on the schematic diagram.

   Change the schematic revision letter to "Rev. E".

2) Change the component layout (drawing number A410929-Rev. F) to revision letter "E" to agree with the schematic and actual board revision letter.

3) Change the parts list on the back of page 5-5 to agree with the above.

# MODEL 6144

For all Control boards (A410903) stamped with revision letter "F":

1) To bring the Control Schematic Diagram (no. C411898-Rev. E) up to revision level "F", change diodes CR1, 2, 4, 5, 8, and 9 from CD6111 to part no. 755-431324. Change diodes CR6, 7, 10, and 11 from HD1842 to part no. 755-431324. Delete the transistor pads.

2) Change the component layout drawing (no. 64A-6100-013-Rev. E) to revision "F" to agree with the above.

3) Change the parts list to agree with the above.

# MODEL 6144

For all 2.5 MHz Input Amplifier assemblies stamped with revision letter "H":

1) To bring the schematic diagram (dwg. no. C416020-Rev. G) up to revision level "H", change CR2 and CR3 from CD6111 (part no. 755-815561) to part no. 755-431324.

2) Change the component layout drawing (dwg. no. A410929-Rev. G) to "Rev. H" to agree with the actual board revision letter.

3) Change the parts list (back of Page 5-5) to agree with the above.

## MODEL 6144

For all Legend assemblies (887-431226) stamped with revision letter "E-1":

1) To bring the schematic diagram (dwg. no. D431228-Rev. E) up to revision level "E-1", delete R30 (330K, and CR4 (1N459).

   Change the schematic revision letter to "Rev. E-1".

2) Change the component layout (dwg. no. C431226-Rev. E) to "Rev. E-1" to agree with the actual board revision letter.

3) Change the parts list (back of Page 5-13) to agree with the above.

## MODEL 6144

For all Legend assemblies (no. 887-431226) stamped with revision letter "E-2":

1) To bring the schematic diagram (dwg. no. D431228-Rev. E-1) up to revision level "E-2", change R24 from 470K, 1/4W, 10% (part no. 601-823961) to 4.7K, 1/4W, 10% (part no. 601-815329), add 5% to the rating of C1. Show a jumper between pin $K_F$ and $H_R$.

   Change the schematic revision letter to "Rev. E-2".

2) To bring the component layout (dwg. no. C431226-Rev. E-1) up to revision level "E-2", show a jumper with teflon sleeve from pin $K_F$ and pin $H_R$.

   Change the component revision letter to "Rev. E-2" to agree with the actual board stamping.

3) Change the parts list for the Legend board to agree with the above.

# MODEL 6144

For all F Logic boards stamped with revision letter "E":

1) To bring the F Logic schematic diagram, Page 5-9a (dwg. no. C412112-Rev. D) up to revision level "E", change CR8 from 1N95 to Beckman part no. 755-431324.

   Change the schematic revision letter to "Rev. E".

2) Change the F Logic component layout, Page 5-10, (dwg. no. 64B-6100-011-Rev. D) from "Rev. D" to "Rev. E" to agree with that of the actual board assembly.

3) Change the parts list to agree with the following:

| Detail No. | Beckman Part No. | Description | Typical Mfgr. & No. | Action |
|---|---|---|---|---|
| CR8 | | | | Delete |
| CR8 | 755-431324 | Diode, Special | Beckman | Add |

# ADDENDUM J

## MODEL 6144

Design changes have resulted in a new assembly to replace the Model 860 DCU. This is the Model 880.

A manual is available in the appendix for the new unit.

# ADDENDUM K

## MODEL 6144

For all Control assemblies stamped with "Rev. F-1":

To bring the schematic diagram (drawing number C411898-Rev. F), component layout drawing (A410903-Rev. F), and associated parts list up to revision level "F-1", change the type of transistor for Q1, 2, and 4 thru 9 from 2N961 (Beckman part number 755-817811) to part number 755-425735.

# ADDENDUM K-1

## MODEL 6144

For all Control assemblies stamped with revision letter "G":

There are no differences between assembly drawings (dwg. no. 64A-6100-013 or A410903) and schematic diagrams (64C-6100-014 or C411898) having revision levels of "F-1" and "G".

ADDENDUM L

# MODEL 6144

For all 2.5 MHz Input Amplifier assemblies stamped with revision letter "I":

1) To bring the schematic diagram (drawing number C416020-Rev. H) up to revision level "I", add diodes CR4 and CR5 (1N754A) in series with CR2 and CR3 as shown in Figure 1. (See also lower left-hand corner of schematic diagram.)

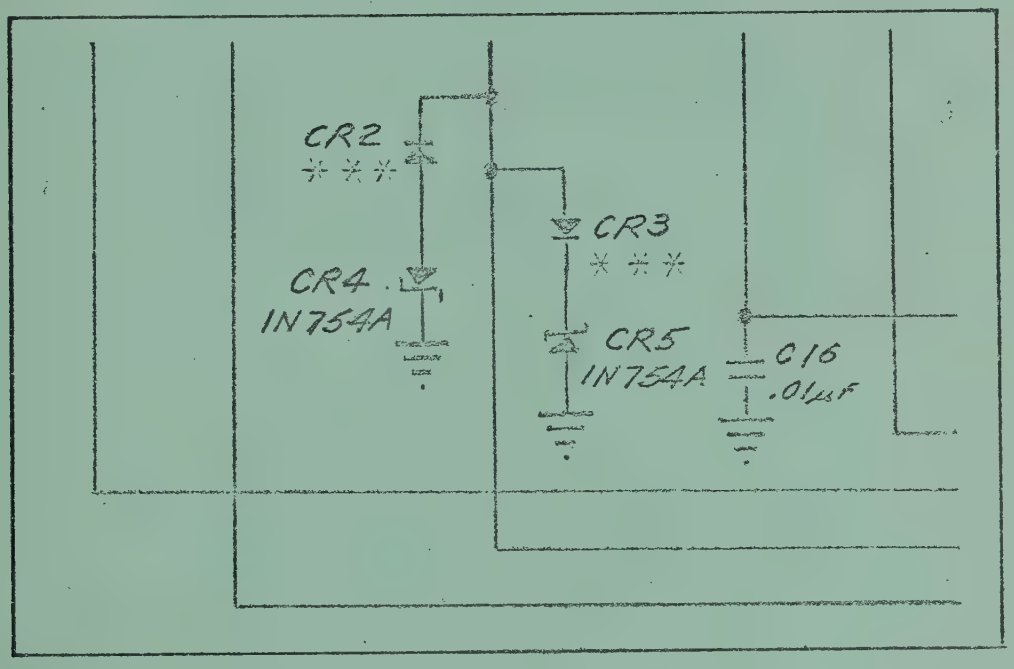



Figure 1

2) To bring the component layout drawing (drawing number A410929-Rev. H) up to revision level "I", add diodes CR4 and CR5 as shown in Figure 2.

3) Change the parts list (on the back of page 5-5) to agree with the above.

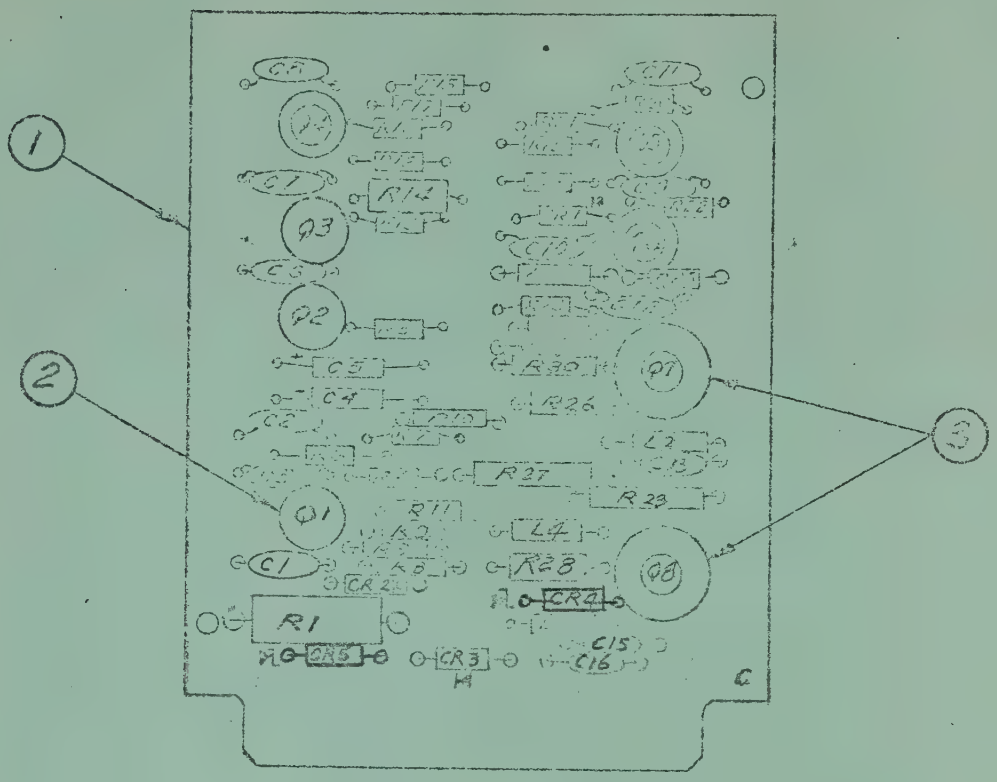

1
2
3
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
R1
R14
R27
R28
C1
C15
C16
CR2
CR3
CR4
CR5
L4

Figure 2

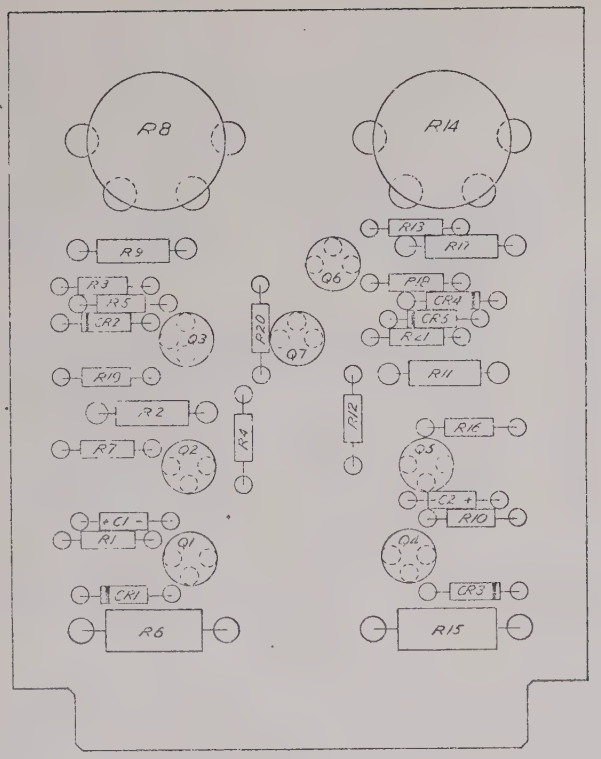
# ADDENDUM M

## MODEL 6144

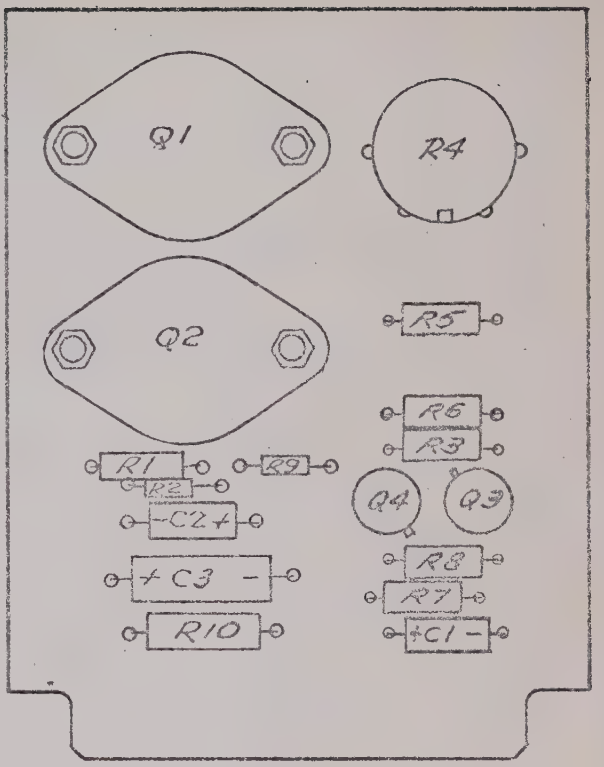
Design changes have resulted in new Regulator and EL Supply board assemblies. This addendum adds the following drawings for the new boards.

| | Dwg. No. |
|---|---|
| Regulator Board Component Layout with Parts List: | C435920-Rev. A |
| EL Supply Board Component Layout with Parts List: | A436030-Rev. A |
| Power Supply Schematic Diagram with Miscellaneous Parts: | D435921-Rev. A |

The previous Regulator (A412442) and EL Supply (A412795) boards and schematic diagram (D411974), as called out in the Contents have been replaced by the above.




REGULATOR BOARD (A34)
COMPONENT LAYOUT




EL SUPPLY BOARD (A35)
COMPONENT LAYOUT

## REGULATOR BOARD (A34) PARTS LIST

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Assy. |
|---|---|---|---|---|
| A34 | 887-435920(A) | Regulator Board | Beckman | 1 |
| C1, 2 | 631-814053 | Capacitor, F. Elect., 1μf, 35V, 20% | Texas Instr. SCM-105FP035C4 | 2 |
| CR1, 3 | 755-404593 | Diode, Silicon, Special | Beckman | 2 |
| CR2, 4 | 755-814019 | Diode, Zener, 400mW | Motorola 1N754A | 2 |
| CR5 | 755-857345 | Diode, Zener | Motorola 1N984B | 1 |
| Q1, 4 | 755-811274 | Transistor, Type 2N445A | Gen. Transistor | 2 |
| Q2, 3, 5, 6 | 755-838105 | Transistor, Germanium, PNP, 150mW max. | Fairchild 2N3638 | 4 |
| Q7 | 755-428280 | Transistor, Special | Beckman | 1 |
| R1, 10 | 601-823934 | Resistor, F.Comp., 270Ω, 1/4W, 10% | Allen Bradley CB2711 | 2 |
| R2 | 601-008065 | Resistor, F.Comp., 100Ω, 1/2W, 10% | Allen Bradley EB1011 | 1 |
| R3, 13 | 601-823104 | Resistor, F.Comp., 390Ω, 1/4W, 10% | Allen Bradley CB3911 | 2 |
| R4, 12 | 601-823105 | Resistor, F.Comp., 470Ω, 1/4W, 10% | Allen Bradley CB4711 | 2 |
| R5 | 601-823112 | Resistor, F.Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 1 |
| R6, 15 | 601-008059 | Resistor, F.Comp., 2.2K, 1W, 10% | Allen Bradley GB2221 | 2 |
| R7, 16 | 601-815239 | Resistor, F.Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 2 |
| R8, 14 | 611-812861 | Resistor, V., W.W., 200Ω, 1.5W, 20% | Chicago Tel. Series 111 | 2 |
| R9, 17 | 601-008071 | Resistor, F.Comp., 330Ω, 1/2W, 10% | Allen Bradley EB3311 | 2 |
| R11 | 601-008068 | Resistor, F.Comp., 180Ω, 1/2W, 10% | Allen Bradley EB1811 | 1 |
| R18 | 601-812856 | Resistor, F.Comp., 2.2K, 1/4W, 10% | Allen Bradley CB2221 | 1 |
| R19, 21 | 601-812741 | Resistor, F.Comp., 100K, 1/4W, 10% | Allen Bradley CB1041 | 2 |
| R20 | 601-822324 | Resistor, F.Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 1 |

## EL SUPPLY BOARD (A35) PARTS LIST

| | | | | |
|---|---|---|---|---|
| A35 | 887-436030(A) | EL Supply Board | Beckman | 1 |
| C1 | 631-824631 | Capacitor, F. Elect., 10μf, 20V, 20% | Sprague 150D106X-0020B2 | 1 |
| C2 | 631-802980 | Capacitor, F.Elect., 22μf, 25V, 20% | Sprague 109D226X-0025C2 | 1 |
| C3 | 631-841374 | Capacitor, F. Elect., 150μf, 20V, 20% | P.R. Mallory MTP157-M020PIC | 1 |
| Q1, 2 | 755-824875 | Transistor, Germanium, PNP, 63W | Motorola 2N2139 | 2 |
| Q3, 4 | 755-838105 | Transistor, Germanium, PNP, 150mW max. | Fairchild 2N3638 | 2 |
| R1, 3 | 601-800031 | Resistor, F.Comp., 470Ω, 1/2W, 10% | Allen Bradley EB4711 | 2 |
| R2 | 601-823917 | Resistor, F.Comp., 10Ω, 1/4W, 10% | Allen Bradley CB1005 | 1 |
| R4 | 611-812861 | Resistor, V., W.W., 200Ω, 1.5W, 20% | Chicago Tel. Series 111 | 1 |
| R5 | 601-008071 | Resistor, F. Comp., 330Ω, 1/2W, 10% | Allen Bradley EB3311 | 1 |
| R6 | 601-008068 | Resistor, F.Comp., 180Ω, 1/2W, 10% | Allen Bradley EB1811 | 1 |
| R7 | 601-010684 | Resistor, F.Comp., 3.3K, 1/2W, 10% | Allen Bradley EB3321 | 1 |
| R8 | 601-007932 | Resistor, F.Comp., 10K, 1/2W, 10% | Allen Bradley EB1031 | 1 |
| R9 | 601-823935 | Resistor, F.Comp., 330K, 1/4W, 10% | Allen Bradley CB3341 | 1 |
| R10 | 604-817358 | Resistor, F.W.W., 1.5K, 1/2W. 5% | I.R.C. | 1 |

## POWER SUPPLY - MISCELLANEOUS PARTS

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Assy. |
|---|---|---|---|---|
| C1, 2, 3 | 631-412828 | Capacitor, F. Elect., 1500μf, 30V | Beckman | 3 |
| C4 | 631-410854 | Capacitor, F. Elect., 300μf, 150V | Beckman | 1 |
| CR1, 2, 3 | 774-824971 | Rectifier Bridge, 3 Amps | Semtech SA780 | 3 |
| F1 | 731-801567 | Fuse, Electric, 1.5 Amps, 125V, T.D. | Littelfuse 31301.5 | 1 |
| K1 | 718-827701 | Relay, 12V, 4 Form C | Potter-Brum. KHP-17D12 | 1 |
| Q1, 2, 3 | 755-822107 | Transistor, Germ., PNP, 2.0mA | Motorola 2N1544 | 3 |
| R2 | 604-857332 | Resistor, 6.2Ω, 5.25W, ±5% | Ohmite 2841 | 1 |
| T1 | 792-435924 | Transformer, Power | Beckman | 1 |
| T2 | 792-411415 | Transformer, EL | Beckman | 1 |
| XF1 | 735-007268 | Fuseholder, 15Amp at 250V Breakdown | Bussman HKP | 1 |
| XK1 | 860-824956 | Socket, Relay | Potter-Brum. 27E003 | 1 |
| Z1 | 771-416479 | Filter, Interference | Beckman | 1 |
| | 241-824552 | Fan Blade, 4" Nylon | Howard Ind. 6-218-152 | 1 |
| | 842-819209 | Fan Motor | Howard Ind. 1075-2302 | 1 |
| | 337-413108 | Fan Guard | Beckman | 1 |
| | 327-404468 | Printed Circuit Board Support | Beckman | 4 |
| | 662-414797 | Power Supply Cable | Beckman | 1 |

A34
REGULATOR
A35
E.L. SUPPLY
TO KV (REGAL)
TO -15V
TO +15V
TO +18V
SEE NOTE 3
FOLLOW
LATCH
OFF
K1 (PLUG-IN RELAY)
T1
T2
T3
CR1
CR2
CR3
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
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---------- NOTE ----------

The Parts List for each individual board is located with its component layout and schematic diagram. Loose components are given with the schematics showing these parts, namely:

6144 Unit Logic Schematic
6144 Count Logic Schematic
Power Supply Schematic

Some miscellaneous chassis and hardware parts are listed with the Outline Drawing.

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Model 850 Decimal Counting Unit (DCU) Instruction Manual
Model 860 Decimal Counting Unit (DCU) Instruction Manual
Data Storage Unit (DSU) Instruction Manual

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# Section 1

# SECTION 1

# INTRODUCTION

## 1.1 GENERAL

The solid-state Beckman Model 6144 is a multipurpose 2.5 mc counter and timer designed to measure frequency, period, time interval, and frequency ratio. This versatility is complemented by an easy-to-read electroluminescent display panel, which provides a seven digit reading, and displays the correct unit of measurement and the appropriate decimal point.

Special features incorporated in the Model 6144 extend the flexibility of the instrument and increase its usability. For example, the MULTIPLE PERIOD setting of the MODE selector allows the operator to time and average as many as $10^6$ periods, thus increasing the accuracy of period measurement.

LATCH and FOLLOW positions of the POWER switch provide another feature. In LATCH, there is a continuous EL display during a count interval, but in FOLLOW the EL display is continuously updated in its presentation during a count interval.

A TEST feature enables the operator to check the instrument for proper operation. See paragraph 2.5.

## 1.2 SPECIFICATIONS

Specifications for the Model 6144 are given in Table 1-1.

Table 1-1

| | |
|---|---|
| Input Frequency Range | |
| Frequency Measurement | dc to 2.5 megacycles |
| Interval Measurement | Period: 1.0 microsecond to $10^7$ seconds with 1.0 microsecond resolution (dc to 1 mc) |

| | |
|---|---|
| | Multiple periods: 3.3 microseconds (dc to 300 kc) |
| Input Resistance | INPUT's X and Y:<br>1 megohm shunted by 40 pf. AC coupling uses a .02 μf, 600V capacitor in series. |
| Input Sensitivity | INPUT's X and Y:<br>0.1 volt rms (0.3 volt peak-to-peak) |
| Maximum Input Voltage | INPUT's X and Y:<br>DC: ±50 volts dc on 1 ATTEN FACTOR, ±600 volts dc on 10 and 100 ATTEN FACTOR<br>AC: 50 volts rms on 1 ATTEN FACTOR, 600 volts peak (dc + ac) on 10 and 100 ATTEN FACTOR |
| Input Attenuation | 1, 10, 100 |
| Trigger Voltage Range | ±1 volt, ±10 volts, and ±100 volts on 1, 10, and 100 ATTEN FACTORS respectively. |
| Resolution | |
| Gating | Better than 0.4 microseconds |
| Counting | Better than 0.4 microseconds |
| Oscillator Stability | 3 parts in $10^7$ per week with ±10% line variation and ±10 degrees C temperature variation |

| | |
|---|---|
| Accuracy<br>Gating<br>Period | <br>±1 count ± time base crystal accuracy.<br>Sine wave single period measurement accuracy is 0.3% at 1 volt rms input, and sine wave noise content 40 db down. |
| Multiple Period | ±0.3% trigger error divided by periods averaged. |
| Time Base | 1μsec. to 10 seconds in decade steps as selected by the TIME selector. |
| Recycle Rate | Continuously variable from 0.1 cps to 7 cps. |
| Visual Readout | Seven electroluminescent digits with automatically selected decimal points and unit nomenclature (KC, MC, μSEC, mSEC, and SEC). |
| Electrical Readout | Four-line 1-2-4-8 binary coded decimal<br>Binary 0: -10 volts with respect to ground.<br>Binary 1: Ground potential or slightly negative. |
| Operating Temperature Range | -20°C to +65°C |
| Storage Temperature | -55°C to +75°C |
| Power Requirements | 117v ac, 50/60 cps, 100 watts |
| Dimensions | 5-1/4" high, 16-3/4" wide, 19" deep |
| Weight | 40 pounds |

## 1.3 APPLICATIONS

Many laboratory, field test, and production line requirements are satisfied with the versatile Model 6144.

Laboratory uses might include frequency and stability checks on circuits under design, period measurements of low frequency waveforms where long term stability is essential, use as a secondary frequency standard, or calibrating less accurate frequency monitoring equipment.

The remote programming feature of this instrument makes it extremely useful for field test applications in integrated systems. An example would be in a military missile check-out system where a computer would remotely program the Model 6144 to measure period, frequency, ratio, etc., of the various electronic circuits in a missile guidance system.

Various transducers such as photocells, magnetic pickups and switches are useful in translating physical phenomena into voltage changes. With appropriate transducers, this instrument measures characteristics of such events relative to time. A few of the many applications are:

| | |
|---|---|
| Frequency measurements | Tachometry |
| Frequency ratio measurements | Telemetry |
| Relay and switch timing | Pulse height analysis |
| Phase measurements | Oscilloscope time base calibration |
| Ballistic measurements | Secondary frequency standard |

## 1.4 ACCESSORIES

The Model 1453 Printer, designed for use with this instrument, converts count information into a printed record on a standard adding machine tape. This printer is ideal for making long term stability checks, recording voltage changes, or making a permanent printed record in control or measuring systems.

Beckman Model 651 Voltage-to-Frequency Converter plug-in indirectly allows the Model 6144 to measure dc voltages from 0.1 volts to 1000 volts. Other plug-ins are being developed for use with this counter.

A Beckman Digital to Analog Converter converts the count accumulated during each counting period to a representative voltage level. This voltage level is retained until a new count is made, at which time the converter changes its voltage level to conform to the new count. The changing levels can control the operation being monitored, or when applied across a self-balancing potentiometer, drive a pen recorder for an analog record.

# Section 2

# SECTION 2

# OPERATION

## 2.1 GENERAL

The Model 6144 has two input circuits, a time base generator, a signal gate, a chain of decimal counting units, and Data Storage Units with an EL display. The input circuits (INPUT's X and Y) produce output pulses representative of the voltage change at their inputs. These pulses can be used as start, stop, or count signals. The time base generator produces clock pulses (selected by TIME selector) which also are used as start, stop or count signals. Depending on the mode (E/UT X, TIM X-Y, etc.) selected by the MODE selector, the three pulse sources supply start signals to open the gate, stop signals to close the gate, and count signals which pass through the gate to be counted by the DCU's. The count accumulated by the DCU's is transferred to the Data Storage Units (DSU's), and then displayed on the EL panel.

In E/UT X, for example, the INPUT X circuit provides count signals, while the clock pulse generator provides start and stop signals. See Section 2.6 for specific information on the individual modes of operation.

## 2.2 APPLYING POWER

The instrument is ready for use as it arrives from the factory. Connect the power cord to a 117v ac, 50-60 cps, outlet. The crystal oven and oscillator circuits energize immediately, and the instrument is ready for operation. After about 72 hours of operation, the oscillator will meet its stability specification. Therefore, if the instrument is used intermittently, leave the power cord connected at all times to avoid waiting for crystal warm-up.

NOTE

> Do not remove the Model 696 Basic Plug-in unless other plug-ins are used. Each plug-in completes certain circuits in the instrument that are essential for operation.

## 2.3 TYPES OF MEASUREMENT

The Model 6144 makes three basic measurements in addition to manually gated counting.

1) It counts the number of events occurring during a precise time interval. This is E/UT operation. Frequency measurements are made in this mode.

2) It measures the time interval between two events. For Time Interval Measurement (TIM) the two events occur on separate input channels. For PERICD measurements the two events occur on the same input channel. If the interval at the same input is multiplied by some factor (10, $10^2$, etc.), thus extending the counting period, the operation is known as MULTIPLE PERICD.

3) It counts the number of events at one input during the interval between consecutive events at the other input. This mode of operation is known as Ratio (more specifically, frequency ratios). Ratio measurements are made in two ways: (a) UNITS Y/PERIOD X, (b) UNITS Y/MULTIPLE PERIOD X.

## 2.4 OPERATING CONTROLS AND CONNECTORS

Operating controls and connectors are described in Table 2-1.

Table 2-1

| Name | Function |
|---|---|
| POWER Switch | Turns power on when turned to LATCH or FOLLOW. |
| FOLLOW Position | Part of POWER switch. Causes EL reading to continually update its presentation during count interval, and then hold reading into next count interval. |

Table 2-1 (continued)

| Name | Function |
|---|---|
| LATCH Position | Part of POWER switch. Readout displays the total count of each counting interval and holds it without change until there is a new total count. |
| TIME Selector | Selects Gate Time for E/UT and TEST measurements. Also selects TIME Units in which measurement appears for 1 PERIOD X, MULTIPLE PERIOD X, and TIM X-Y.<br><br>Selects INPUT Y Circuit for ratio measurement. |
| MODE Selector | Interconnects logic blocks to perform the measurement indicated. |
| ATTEN FACTOR Control | Attenuates the signal and dc level at the input jack by the factor to which the control is set.<br><br>Selects ac or dc input coupling to the attenuator. |
| TRIGGER Control | Selects the instantaneous voltage at which the input signal causes the input trigger circuit to generate an output pulse. |
| SLOPE Switches | Determine which slope (positive or negative) of the input signal will start or stop the counting action. |

Table 2-1 (continued)

| Name | Function |
|---|---|
| RECYCLE RATE Control | Controls the rate at which the instrument will sample new data. In MAX position, counter recycles at a maximum rate. Set to MAN, instrument recycle is manually controlled by pressing RESET push-button. |
| Manual RESET Pushbutton | With latched indication the RESET control performs either of two functions dependent upon whether the Count Gate is closed or open.<br>1) Closed - accumulated data is transferred to the DSU's and presented on the EL display and a new count accumulated.<br>2) Open - instrument is reset to zero and a new count accumulated. Stored data is retained. With FOLLOW indication the RESET control causes instrument to reset to zero and accumulate a new count. |
| INPUT Jacks | For signal inputs to INPUT's X and Y. |
| GATE OPEN Light | Light is on when count gate is open. Provides additional visual indication of counter recycle. |

NOTE

See Auxiliary Connectors, Section 2.9, for information on connectors used in special variations of the standard operating procedure.

## 2.5 TESTING FOR PROPER OPERATION

The self-checking procedure is simple, quick, and may be performed each time the instrument is energized.

1) Set POWER switch to LATCH.

2) Turn RECYCLE RATE control fully clockwise to obtain a maximum recycle rate.

3) Turn MODE selector to TEST.

4) Turn TIME selector to each time position starting with 1 μsecond and continuing to 10 seconds. Correct count indications are shown in Table 2-2.

Table 2-2

| TIME SELECTOR POSITION | CORRECT COUNT INDICATIONS | | |
|---|---|---|---|
| 1 μsec. | 0000000 | 0000001 | 0000002 |
| 10 μsec. | 0000009 | 0000010 | 0000011 |
| 0.1 msec. | 0000099 | 0000100 | 0000101 |
| 1 msec. | 0000999 | 0001000 | 0001001 |
| 10 msec. | 0009999 | 0010000 | 0010001 |
| 0.1 sec. | 0099999 | 0100000 | 0100001 |
| 1 sec. | 0999999 | 1000000 | 1000001 |
| 10 sec. | 9999999 | 0000000 | 0000001 |

5) If a correct count indication appears at all positions, the instrument is operating properly.

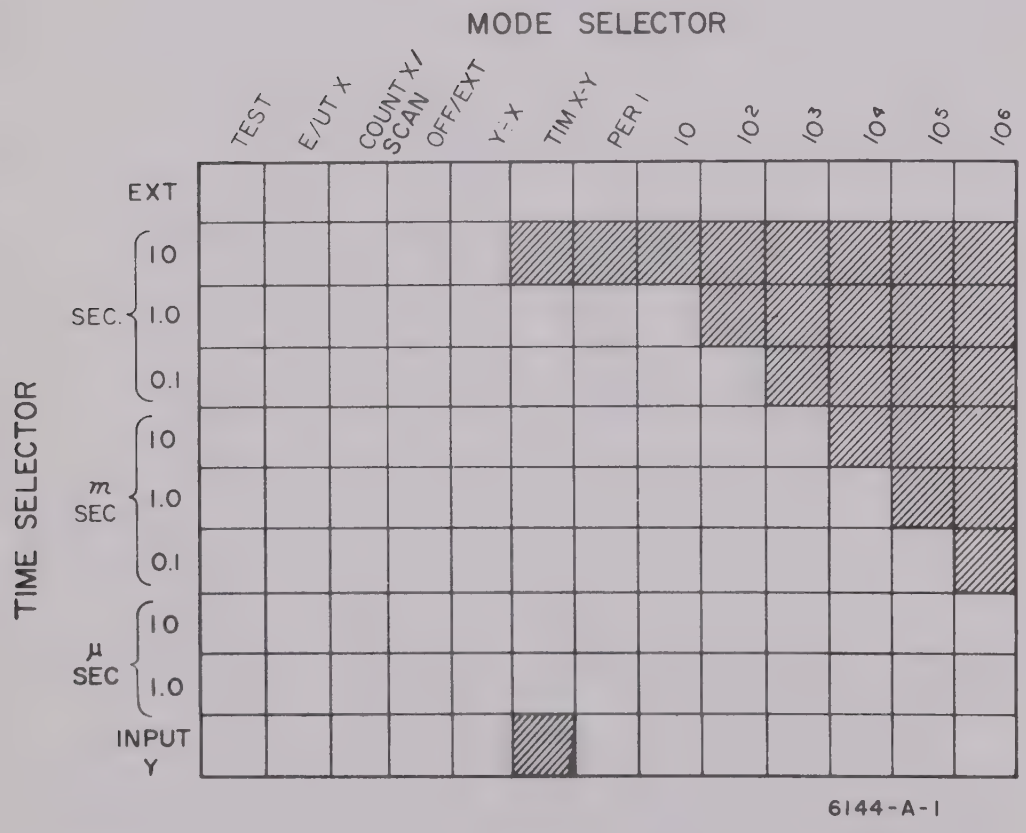
6) Instrument may be tested in FOLLOW to observe count change. Retard RECYCLE RATE control to approximately 1 reading per second for best observation.

## 2.5.1 EL Indicator Panel Check

To visually test the EL indicator panel, place the MODE selector in $10^6$ MULTIPLE PERIOD X and the TIME selector in any position from 1.0 μseconds to 10 seconds. All eights will appear on the panel showing the 7-bar configuration of each of the 7 digits.

Any incompatible setting of the TIME and MODE selectors will cause all eights to appear on the EL panel. Table 2-3 shows the incompatible positions of the two controls.

Table 2-3




Indicates incompatible positions of the TIME and MODE Selectors (all eights appear on the readout)

As shown in Table 2-3, the TIM X-Y and 1 PERIOD X modes are made incompatible with a 10 second time base. The long time duration needed between start and stop pulses, to allow enough counts (1 count/10 seconds) to be accumulated by the DCU's, make these modes of operation impractical. For example, in order to count ten clock pulses from the time base, the start and stop pulses would have to be separated by 100 seconds.

Table 2-3 also shows that MULTIPLE PERIOD positions (10, $10^2$, etc,) of the MODE selector are incompatible with certain positions of the TIME selector. To understand why some TIME and MODE selector positions are incompatible, it is first necessary to understand the operation of the DCU divider chain.

The DCU divider chain serves as time base dividers, or as dividers for MULTIPLE PERIOD operation. Each DCU in the divider chain performs one function, i.e., to divide its input by 10. The DCU cannot simultaneously divide clock pulses, and also divide a series of pulses from the INPUT X circuit in some MULTIPLE PERICD position. Therefore, the DCU can only be used for one function at a time.

Thus, incompatible positions occur when the same DCU is selected for simultaneous use as a time base divider and as a divider for MULTIPLE PERIOD operation.

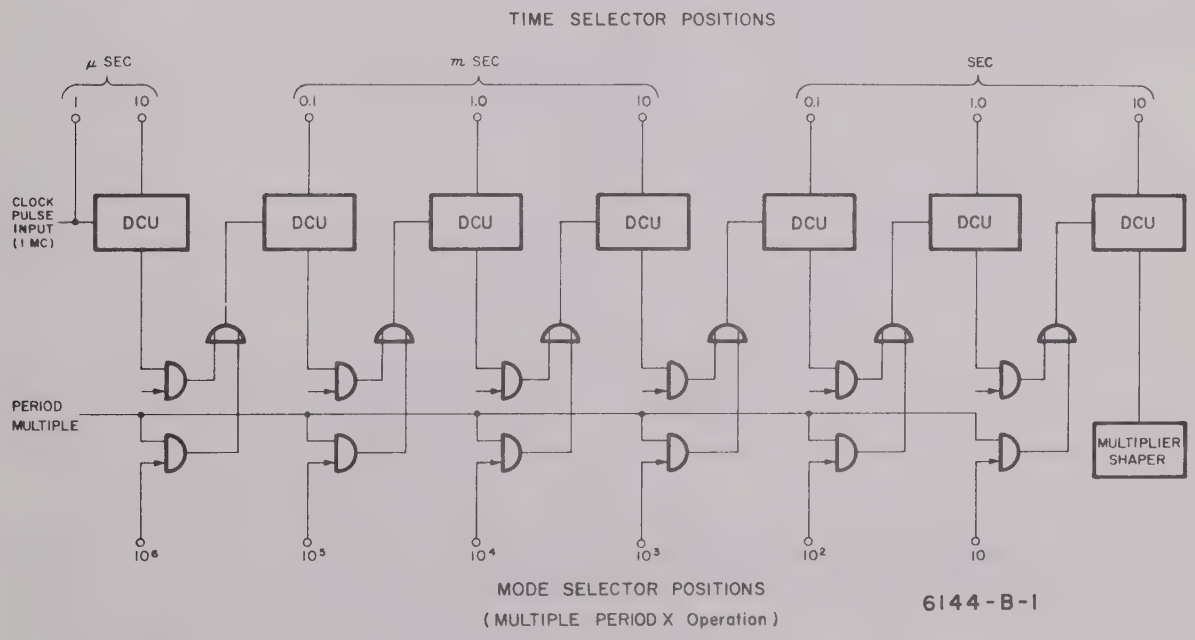



FIG. 2-1. Simplified Block Diagram of DCU Divider Chain.

For example, setting the TIME selector to 1 mSEC and the MODE selector to $10^5$ PERIOD X causes the same DCU to perform two functions. This results in an incompatible position. Figure 2-1 shows the logic of the DCU divider chain.

With the TIME selector in UNITS Y and the MODE selector in TIM X-Y, eights appear in the readout. Input Y provides the pulse to close the count gate; therefore, any pulse that could be counted would also close the gate.

## 2.6 MODES OF OPERATION

Refer to Table 2-4.

Table 2-4

| Modes of operation | What the instrument does in each mode |
|---|---|
| TEST | Counts 1.0 mc oscillator output during each timing interval. |
| E/UT X | Counts events at INPUT X during a time unit selectable between 1 $\mu$second and 10 seconds by TIME selector (frequency measurement). |
| COUNT X/SCAN | SCAN: Counts events at INPUT X during manually controlled multiples of the time base.<br>COUNT X: Counts events at INPUT X during manually controlled counting period. |
| OFF | For manual control of COUNT X. |
| Y ÷ X | Measures ratio of INPUT Y frequency to INPUT X frequency (number of events at INPUT Y during one event at INPUT X). |

Table 2-4 (continued)

| Modes of operation | What the instrument does in each mode |
|---|---|
| TIM X-Y | Time Interval Measurement - Measures the interval between an event at INPUT X and an independent event at INPUT Y. Time units (1 $\mu$sec. to 1 sec.) selected by TIME selector. |
| PERIOD X | 1 PERIOD X: Measures the time interval between consecutive events at INPUT X. Time units (1 $\mu$sec. to 1 sec.) selected by TIME selector.<br><br>MULTIPLE PERIOD X: Measures the time interval between multiple events (10, $10^2$, . . . $10^6$) at INPUT X. |
| Ratio | UNITS Y/1 PERIOD X: TIME selector set to UNITS Y, and MODE selector to 1 PERIOD X. Measures ratio of INPUT Y frequency to INPUT X frequency (number of events at INPUT Y during one event at INPUT X).<br><br>UNITS Y/MULTIPLE PERIOD X: TIME selector set to UNITS Y, and MODE selector to one of the MULTIPLE PERIOD positions (10, $10^2$, . . . $10^6$). Measures ratio of INPUT Y frequency to multiples of INPUT X frequency. |

## 2.6.1 E/UT X MODE

With the MODE selector in E/UT X, the instrument counts events at INPUT X during unit of time selectable between 1$\mu$second and 10 seconds (frequency measurements). The functional blocks connect as shown in Figure 2-2.

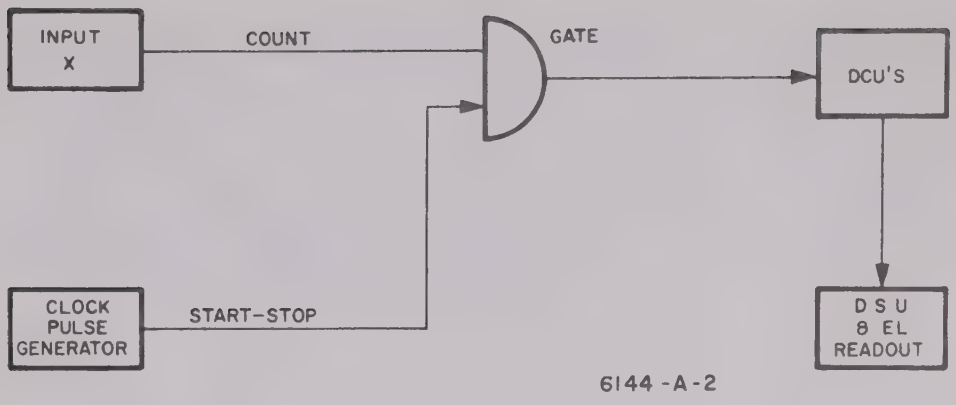



FIG. 2-2. E/UT X MODE.

Operating Procedure

1) Connect the input signal to the INPUT X. Adjust the ATTEN control as described in Section 2.7.7.

2) Turn the MODE selector to E/UT X.

3) Set the TIME selector to the time interval over which events are to be counted. A longer time base will increase the number of digits displayed, thus increasing measurement accuracy.

4) Adjust RECYCLE RATE control for a convenient reading or recording rate.

5) The readout displays count, units, and decimal point

## 2.6.2 SCAN

Counts events at INPUT X during manually controlled multiples of the time base setting. The SCAN function provides a method of measuring low frequencies accurately without resorting to period measurement. The functional blocks connect as shown in Figure 2-3.

1) Connect the input signal to INPUT X. Adjust ATTEN control as described in Section 2.7.7.

2) Switch RECYCLE RATE control to MAN.

3) Turn MODE selector to E/UT X.

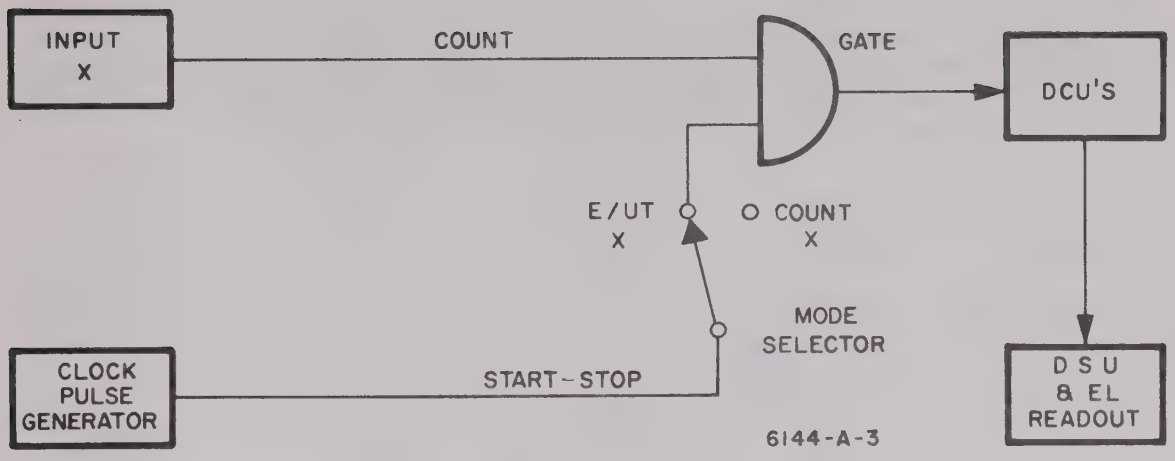



FIG. 2-3. SCAN

4) Turn TIME selector to 10 SEC.

5) Turn POWER switch to either LATCH or FOLLOW.

6) Press the RESET pushbutton to start the counting action, and begin timing the desired number of period measurements. With TIME selector in 10 SEC, each timing period is 10 seconds.

7) Quickly turn MODE selector to COUNT X. Continue timing the periods.

8) Approximately half-way through the last timing period, turn the MODE selector back to E/UT X. Counting will stop with the next stop pulse.

9) Count remains on EL display until instrument is manually recycled.

10) To obtain the input frequency in events per second, divide the count indication by the total counting interval in seconds. Example: If the count displayed is 10,000 and the number of timing periods is 100 (10 seconds times 10 periods = 100), the input frequency in events per seconds is 100

11) To start a new measurement, repeat steps 6, 7, 8, and 9.

## 2.6.2 COUNT X MODE

With the MODE selector at COUNT X, the instrument counts events at INPUT X during manually controlled counting period. The functional blocks connect as shown in Figure 2-4.

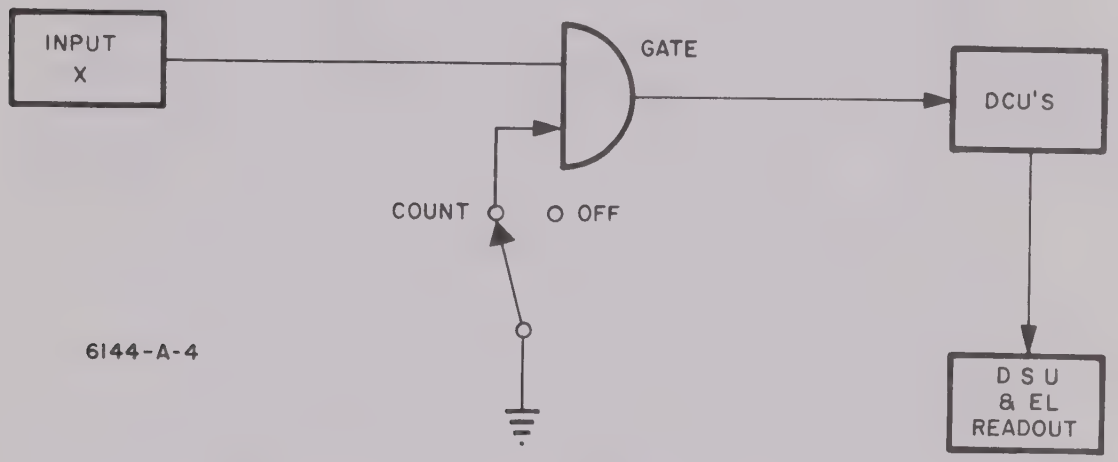



FIG. 2-4. COUNT X MODE.

### Operating Procedure

1) Connect input signal to the INPUT X jack. Adjust the ATTEN control as described in Section 2.7.7.

2) Turn MODE selector to OFF.

3) Press manual RESET button. This resets counter to zero.

4) Turn MODE selector to COUNT. This begins the counting action. The input channel will trigger only on the negative slope of the input waveform.

5) Turn MODE selector to OFF to stop the counting. The GATE OPEN light will stay on continuously in this mode of operation.

6) Read the count indication. To continue counting without erasing the previous indication, turn MODE selector back to COUNT.

## 2.6.4 TIM X-Y MODE

With the MODE selector in TIM X-Y, the instrument measures the interval between an event at INPUT X and an independent event at INPUT Y. The functional blocks connect as shown in Figure 2-5.

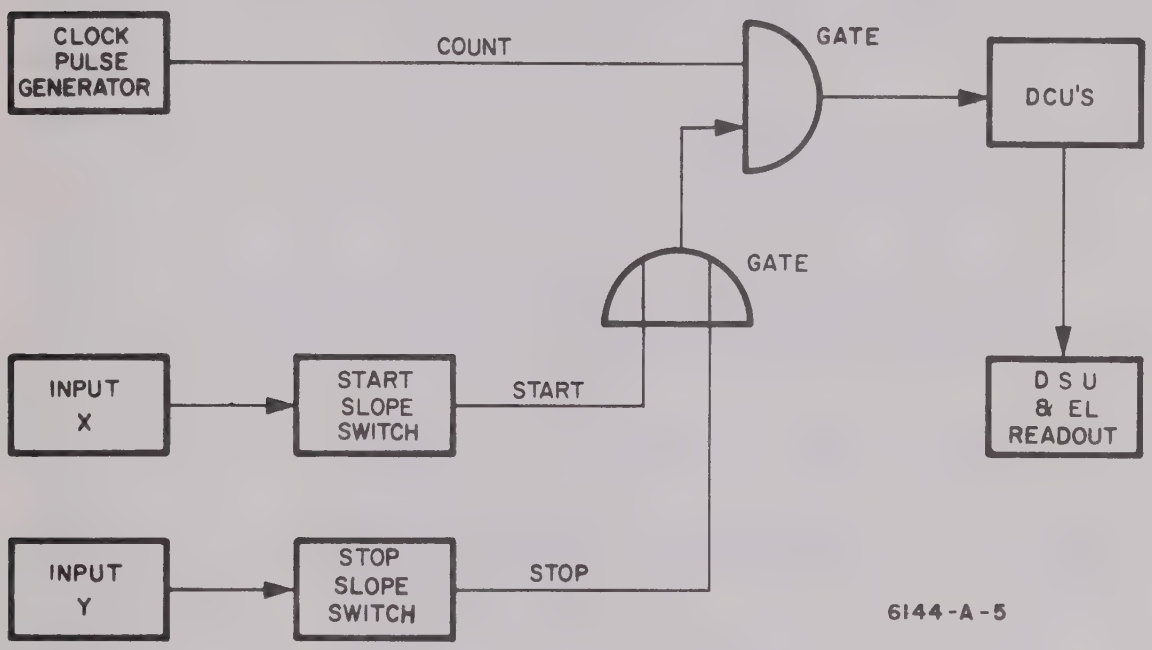



FIG. 2-5. TIM X-Y MODE.

### Operating Procedure

1) Connect the stop signal to INPUT Y. Adjust INPUT Y TRIGGER control as described in Section 2.7.8.

2) Connect the start signal to INPUT X. Adjust INPUT X TRIGGER control as described in Section 2.7.7.

3) Turn MODE selector to TIM X-Y.

4) The START and STOP SLOPE switches select the polarity of the voltage excursion that starts and stops the counting period, respectively.

5) Set the TIME selector to the desired unit of time measurement. For example, at the 1 mSEC position the time measurement appears with one millisecond resolution. The smaller the time unit chosen, the greater the resolution.

6) Adjust the RECYCLE RATE control for a convenient reading or recording rate.

7) The readout automatically displays count, units, and decimal point.

## 2.6.5 PERIOD Measurement

### 2.6.5.1 PERIOD X MODE

With the MODE selector in 1 PERIOD X, the instrument measures the interval between consecutive events at INPUT X. This mode measures the period of a cyclical waveform, the width of a pulse, or separation of pulses. The functional blocks connect as shown in Figure 2-6.

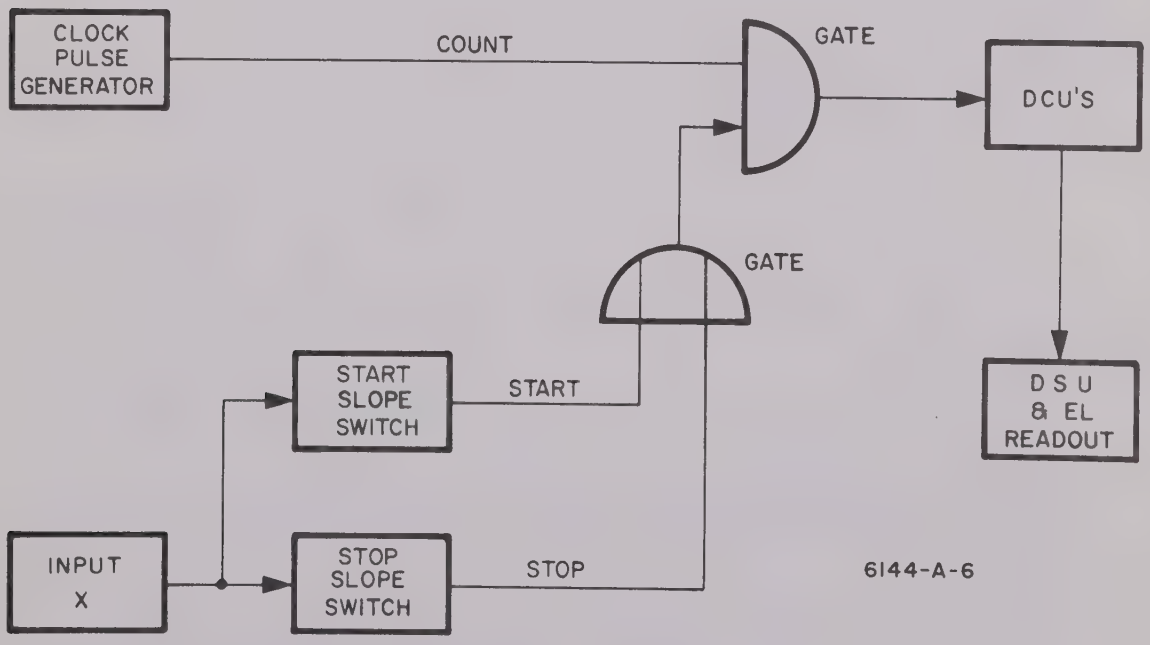



FIG. 2-6. PERIOD X MODE.

Operation Procedure

1) Connect input signal to INPUT X. Adjust the ATTEN control as described in Section 2.7.6. An oscilloscope may be required to position trigger points on asymmetrical waveforms. A SCOPE jack on the rear panel provides an output representing the Count Gate. Triggering the oscilloscope at the opening or closing of the Count Gate while monitoring the input waveform, permits the operator to see the start or stop points on the input waveform.

2) Turn MODE selector to 1 PERIOD X.

3) The START SLOPE switch selects the polarity of the voltage excursion that starts the timing period; the STOP SLOPE switch selects the polarity of the excurstion that stops timing. Therefore,

   a) To measure the period of a cyclical waveform, set both SLOPE switches to "+" or both to "-".

   b) To measure the width of a positive waveform, set the START SLOPE switch to "+" and the STOP SLOPE switch to "-".

   c) To measure the width of a negative waveform, set the START SLOPE switch to "-" and the STOP SLOPE switch to "+".

   d) To measure positive pulse separation, set the START SLOPE switch to "-" and the STOP SLOPE switch to "+", or vice versa for negative pulses.

4) Switch the TIME selector to the desired unit of time measurements. For example, at the 1 mSEC position the time measurement appears with one millisecond resolution. The smaller the time unit chosen, the more accurate the reading within limits of period accuracy.

5) Adjust the RECYCLE RATE control for a convenient reading or recording rate.

6) Readout automatically displays count, units, and decimal point.

## 2.6.5.2 MULTIPLE PERIOD X MODE

With the MODE selector at one of the MULTIPLE PERIOD positions (10, $10^2$, . . . $10^6$), the instrument measures the interval between multiple events at INPUT X. These settings will measure the period of an event more accurately than 1 PERIOD X by averaging a greater number of periods over which counting occurs. The functional blocks connect as shown in Figure 2-7.

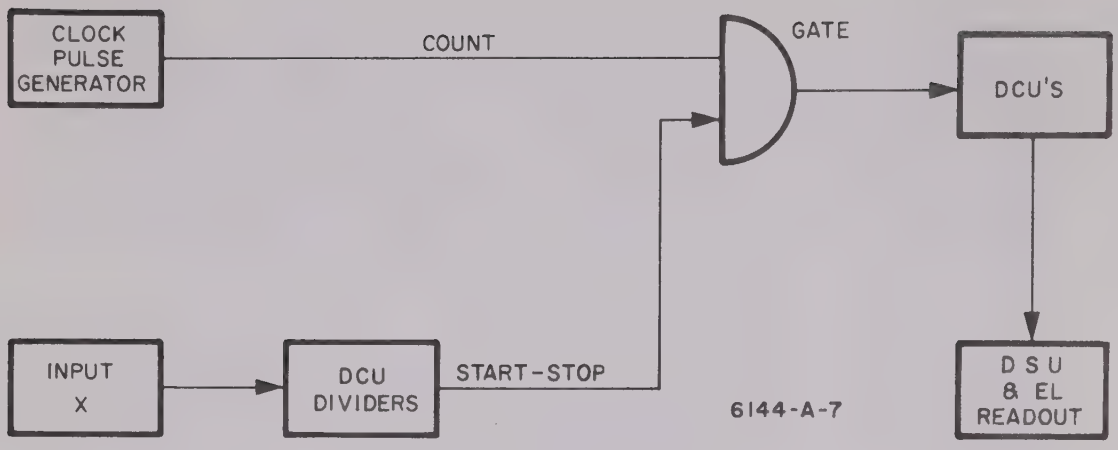



FIG. 2-7. MULTIPLE PERIOD X MODE.

Operating Procedure

1) The INPUT X TRIGGER adjustment is made the same as in 1 PERIOD X. The maximum frequency that can be used in MULTIPLE PERIOD X is 300 kc as limited by the DCU dividers.

2) Select a position (10, $10^2$, . . . $10^6$) on the MODE selector. The larger the number, the greater the number of periods over which counting will be averaged.

3) Set the TIME selector to desired unit of time measurement. The smaller the time unit chosen, the greater the resolution.

NOTE

There are certain positions of the TIME and MODE selectors that are incompatible. See Table 2-2.

4) INPUT X triggers only on the negative slope of the input waveform.

5) Adjust the RECYCLE RATE control for a convenient reading or recording rate.

6) Readout automatically displays count, units and decimal point.

## 2.6.6 Ratio Measurements

### 2.6.6.1 UNITS Y/PERIOD X MODE

With the MODE selector in 1 PERIOD X and TIME selector in UNITS Y, the instrument measures ratio of INPUT Y frequency to INPUT X frequency (number of events at INPUT Y during one event at INPUT X). Functional blocks connect as shown in Figure 2-8.

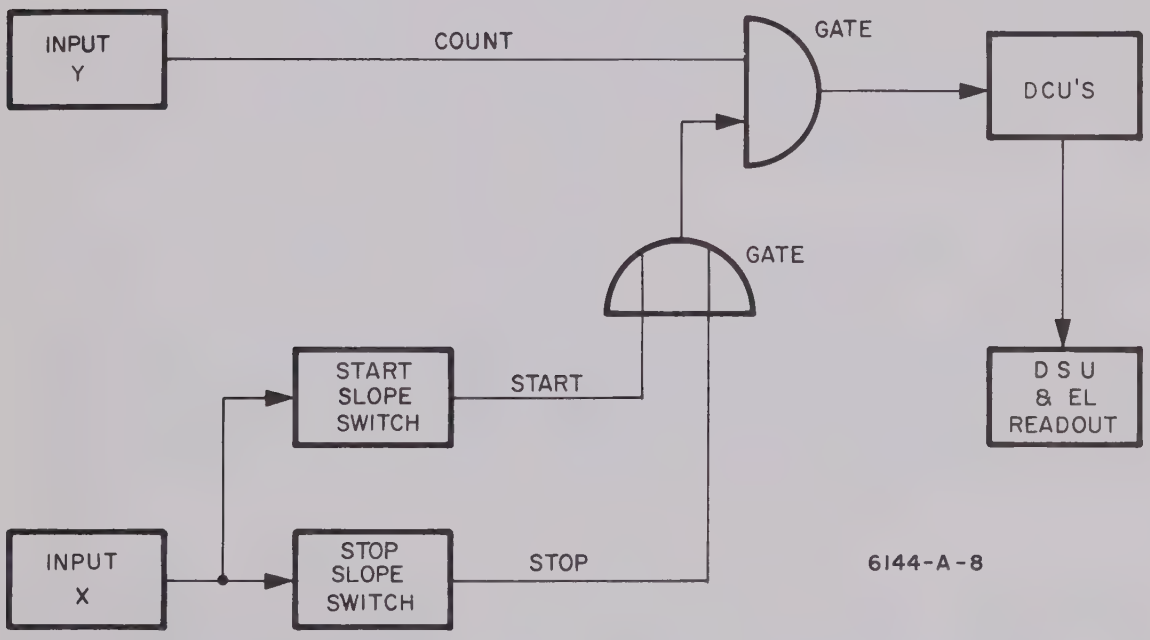



FIG. 2-8. UNITS Y/PERIOD X MODE.

Operating Procedure

1) Connect the higher frequency to the INPUT Y. Adjust INPUT Y ATTEN control as described in Section 2.7.8.

2) Connect the lower frequency to the INPUT X. Adjust INPUT X ATTEN control as described in Section 2.7.7.

3) Switch MODE selector to 1 PERIOD X, and the TIME selector to UNITS Y.

4) The START SLOPE switch determines the polarity of the voltage excursion that starts the counting period. The STOP SLOPE switch sets the polarity of the voltage excursion that stops the counting period. Therefore,

   a) When measuring the ratio of two frequencies set both SLOPE switches to "+" or both to "-".

   b) When counting the INPUT Y during the period that INPUT X voltage remains below a certain negative level, set the START SLOPE switch to "-" and the STOP SLOPE switch to "+".

5) The INPUT Y triggers on a negative-going input.

6) Adjust the RECYCLE RATE control for a convenient reading or recording rate

7) The readout automatically displays count information.

### 2.6.6.2 UNITS Y/MULTIPLE PERIOD X

With the MODE selector in one of the MULTIPLE PERIOD X positions and the TIME selector in UNITS Y, the instrument measures ratio of INPUT Y to multiple events at INPUT X. Ratio measurements are more accurate using multiple periods because a greater number of periods are averaged over which INPUT Y is counted. Functional blocks connect as shown in Figure 2-9.

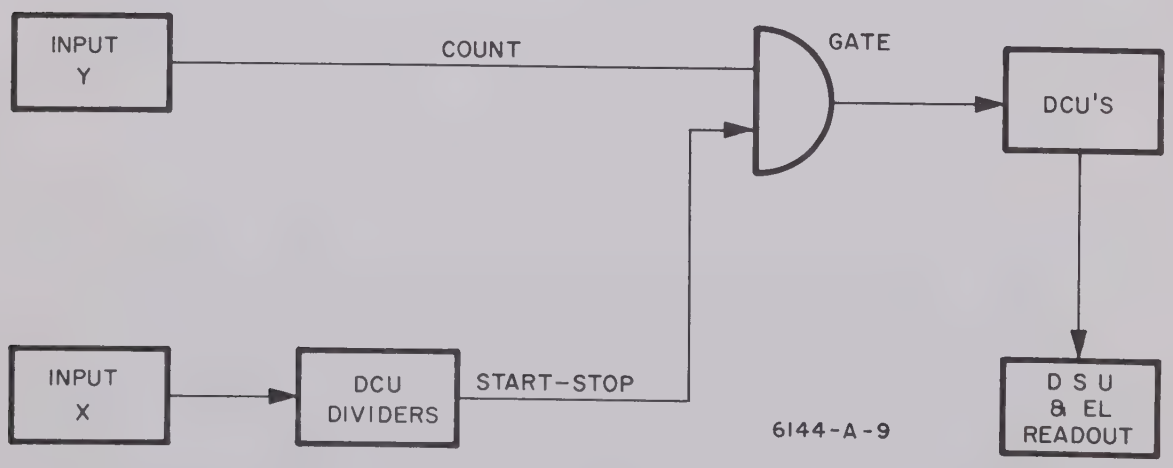



FIG. 2-9. UNITS Y/MULTIPLE PERIOD X.

Operating Procedure

1) Set up the input channels as in UNITS Y/1 PERIOD X.

2) Turn MODE selector to some position of MULTIPLE PERIOD X (10, $10^2$, . . . $10^3$, etc.). The number of periods selected determines the number of events required at INPUT X to start and stop counting. Counting starts and stops on the negative-going slope of the INPUT X signal for periods of 10 through $10^6$.

3) Switch TIME selector to UNITS Y. The INPUT Y channel triggers on the negative-going input signal.

4) Adjust RECYCLE RATE for a convenient reading or recording rate.

5) The readout displays count information and automatically places the decimal.

## 2.6.6 Y ÷ X MODE

With MODE selector in Y ÷ X, the instrument measures ratio of INPUT Y frequency to INPUT X frequency (number of events at INPUT Y during one event at INPUT X). When used with the Transfer Oscillator, the TIME selector is used to select a desired frequency from the time base with output available at the rear panel.

## 2.7 INPUT'S X AND Y

Information in this section applies to both INPUT's X and Y, since these input circuits are identical. Figure 2-10 is a block diagram of one of these input circuits.

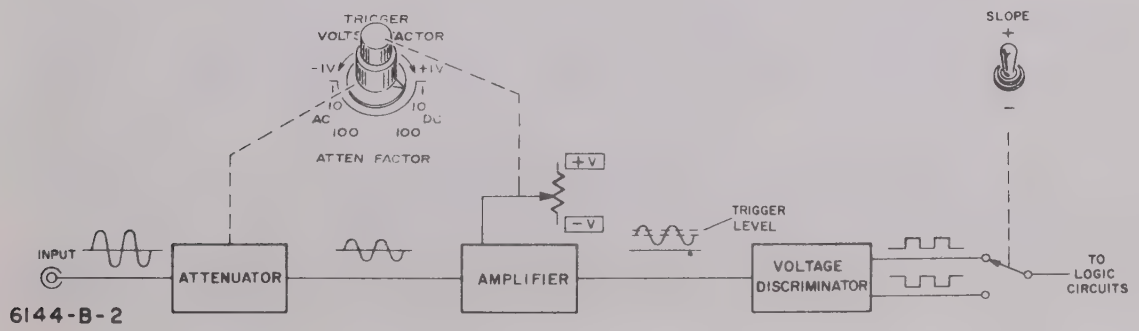



FIG. 2-10. Simplified Input Circuit Block Diagram.

### 2.7.1 ATTEN FACTOR Control

### 2.7.2 Input Coupling

The ATTEN FACTOR selector selects AC or DC coupling and input attenuation. In the DC position the dc (plus the ac component of the input signal) couples to the attenuator. Switching to AC places a .02μf, 600 vdc capacitor between the input jack and the attenuator permitting only the ac component of the input to reach the attenuator. The equivalent input circuit is 1 megohm for all ATTEN FACTOR positions. The input circuit is shunted with approximately 40 pf at each attenuator position. A typical drift figure at the DC "1" position is 3 mv/°C.

### 2.7.3 Attenuation

Each position of the ATTEN FACTOR control divides the input signal by the factor indicated (1, 10, and 100). Effectiveness of the TRIGGER control depends on the correct use of the ATTEN FACTOR control. Since these two controls are interdependent, the use of the ATTEN FACTOR control is discussed with the TRIGGER control in Section 2.7.4.

### 2.7.4 The TRIGGER Control

As shown in Figure 2-10, the TRIGGER control is part of the amplifier, and determines the voltage at which an input signal causes the input circuits to generate an output pulse. The amplifier output signal drives a voltage discriminator circuit. The discriminator exhibits a characteristic known as hysteresis. Hysteresis is a small, fixed voltage range, centered around a fixed dc level at the discriminator's input. When a voltage change passes through this hysteresis range, the discriminator output changes voltage levels (Figure 2-11A). This voltage level remains until a voltage change again passes back through this hysteresis range, at which time the discriminator's output returns to its original state (Figure 2-11B).

The amplifier output is shifted by the TRIGGER control in either a positive or negative direction to allow the operator to choose a particular point on the waveform to trigger the discriminator circuit. As long as the amplitude of the voltage change is large enough to pass through the hysteresis range, triggering will occur.

For example, with the ATTEN FACTOR control in AC "1", the TRIGGER control adjustment range is ±1 volt; that is, it can shift a signal referenced at the input over a ±1 volt range at the discriminator's input. Using a 10 volt p-p input, the ±1 volt adjustment range is not adequate to shift the 10

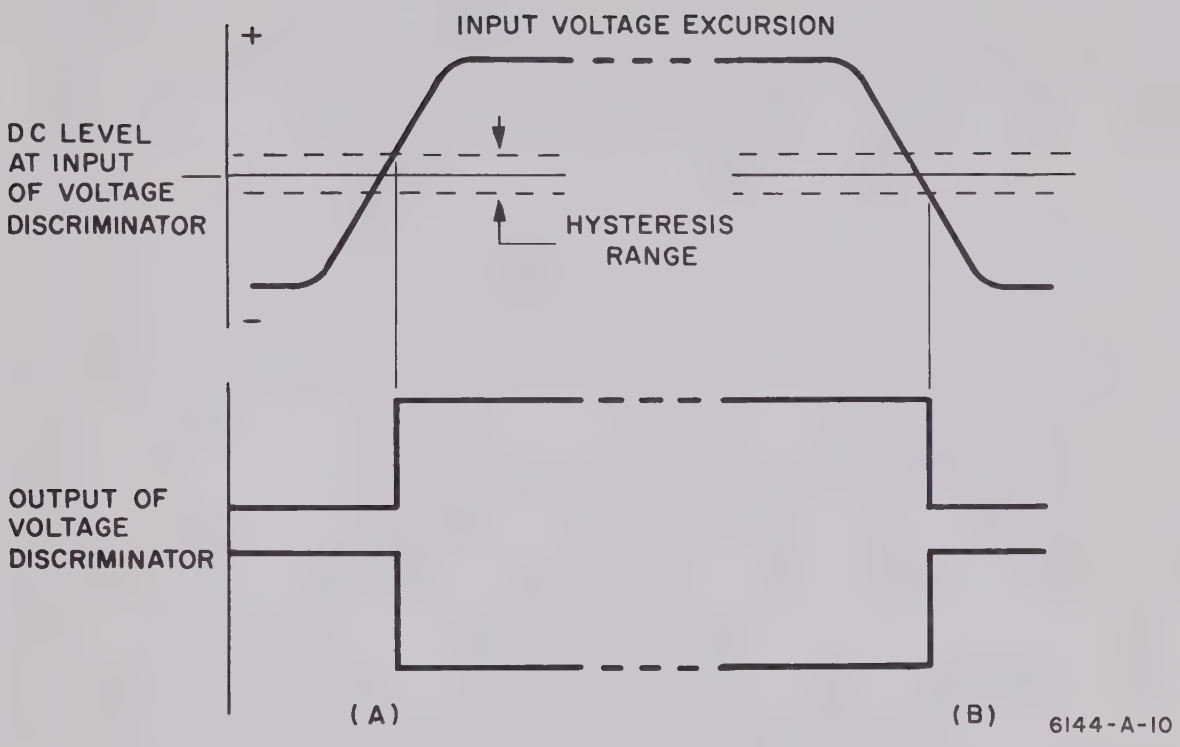



FIG. 2-11. Shows output of voltage discriminator as a voltage change passes through hysteresis range.

volt p-p signal enough in a positive or negative direction to permit any desired part of the signal to pass through the hysteresis range of the discriminator circuit (see Figure 2-12A). Therefore, the ATTEN FACTOR control becomes important. By setting the ATTEN FACTOR control to AC "10", the input signal driving the amplifier is attenuated by a factor of 10, thus the signal driving the amplifier is 1 volt p-p. A 1 volt p-p signal can be shifted enough so the desired part passes through the hysteresis range of the discriminator circuit (see Figure 2-12B).

The input signal is reduced to fall within the range of the TRIGGER control. Therefore, effective range of this control is multiplied by the setting of the ATTEN FACTOR (i.e., 10, 100).

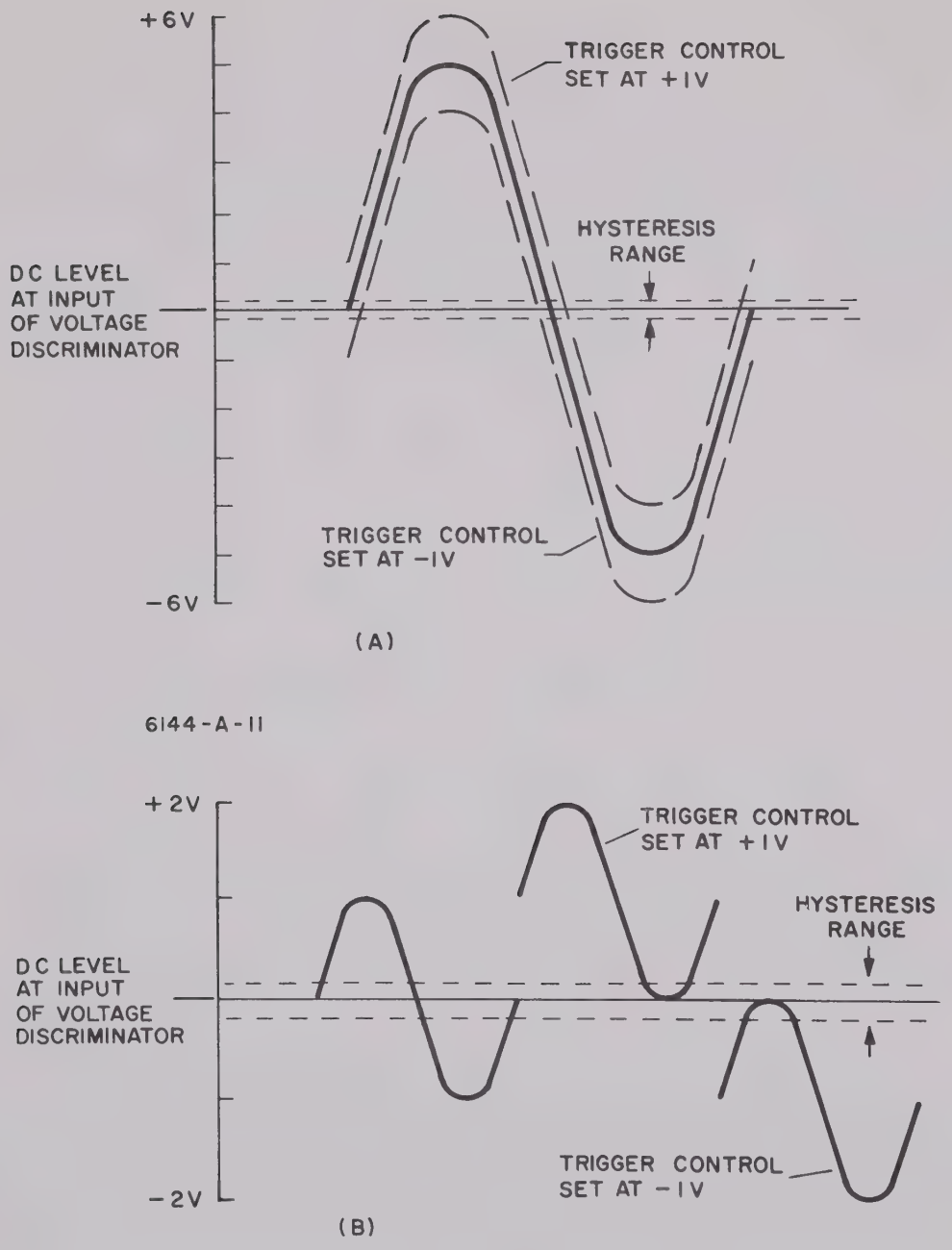



FIG. 2-12. (A) shows that the TRIGGER control range is not enough to shift any part of the input signal through the hysteresis range of the voltage discriminator; (B) shows the signal attenuated enough so it passes through this range.

For dc coupled signals, the dc level (plus the ac component) has to be considered in adjusting the ATTEN FACTOR and TRIGGER controls. If the dc level is large, the ac component may never be within range of the TRIGGER control; therefore, the ATTEN FACTOR control may have to be set to 10, or 100. However, since the ac component is also attenuated, it may then be less than minimum sensitivity of the discriminator circuit.

### 2.7.5 SLOPE Switches

The SLOPE switch determines which slope (positive or negative) of the input signal will start or stop the counting.

Figure 2-13 shows the input signal slopes in relation to the discriminator output pulse.

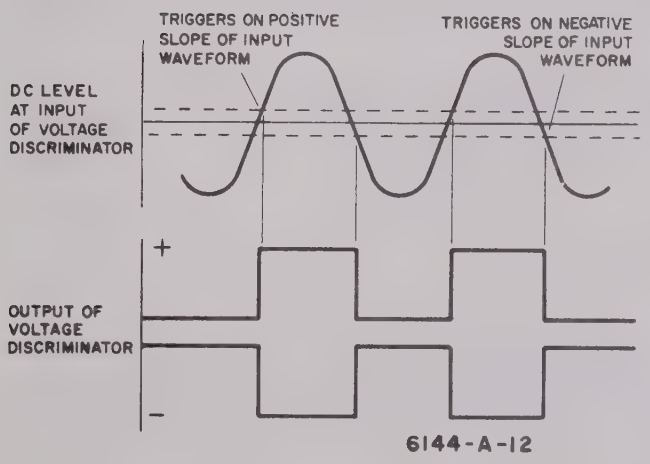

TRIGGERS ON POSITIVE SLOPE OF INPUT WAVEFORM
TRIGGERS ON NEGATIVE SLOPE OF INPUT WAVEFORM
DC LEVEL AT INPUT OF VOLTAGE DISCRIMINATOR
+
OUTPUT OF VOLTAGE DISCRIMINATOR
-
6144-A-12

FIG. 2-13.

Shows output of voltage discriminator with sine wave input; also relationship of input signal slope to voltage discriminator output.

Logic circuits in this instrument respond only to positive going slopes of the voltage discriminator output; therefore, it is possible to select the desired slope of the input signal to operate the instrument.

For example, the period of a sine wave can be determined by setting both SLOPE switches to "+" or "-". The positive slopes of the input waveform correspond to the "+" setting of the SLOPE switch and to the positive-going slope of the positive output pulse of the discriminator. The negative slopes of the input waveform correspond to the "-" setting of the SLOPE switch and to the positive-going slope of the negative output pulse of the discriminator.

### 2.7.6 Using the TRIGGER control

The purpose of the input trigger channel is to produce a reliable pulse output representing a selected part of the input signal. Proper adjustment of the ATTEN FACTOR and TRIGGER controls ensures this condition. Before adjusting the controls, try to visualize the input waveform, noting the ac amplitude and dc level. The effect of various control settings is as follows:

1) If the attenuated signal is small (p-p), the trigger voltage level may be set too high or too low to produce a pulse.

2) If the attenuated voltage variations "ride" on a dc level, they may not come within the trigger voltage range.

3) Modulation or other variation of the attenuated signal is least likely to cause trigger failure if the trigger voltages are set about halfway between the peaks of the signal.

4) Extraneous signals (noise or modulation) have the least effect on the time at which a pulse occurs when the input circuit triggers on a steep slope of the waveform.

5) Noise below the range of the trigger circuit will not trigger extraneous pulses. Consequently, attenuating a noisy signal may reduce the effect of the noise.

6) Attenuating the input signal:

   a) Reduces the slope at all points.

   b) Shifts the ac component nearer ground if it rides on a dc level.

   c) Increases the minimum p-p variations necessary to trigger the input circuit (measured at the INPUT).

   d) Increases the range of possible trigger voltage control over the input signal from ±1 volt to ±100 volts.

### 2.7.7 INPUT X TRIGGER Control Adjustment

1) Set ATTEN FACTOR control to 100.

2) Couple signal to INPUT X.

3) Switch MODE selector to COUNT X.

4) Slowly turn TRIGGER control between its extreme positions, and note whether counting occurs. If counting occurs, proceed to step 6; otherwise, continue on to step 5.

5) Repeat step 4, each time reducing the attenuation factor, i.e., 10, 1, until counting occurs. If no counting occurs in ATTEN "1", determine if an adequate input signal is present.

6) By turning the TRIGGER control, determine the positions which start and stop counting, then set the control midway between two positions. The INPUT X trigger circuit should now be operating properly.

7) Refer back to Mode of Operation section (Section 2.6) for further information on mode being used.

### 2.7.8 INPUT Y TRIGGER Control Adjustment

1) Make sure no signal is connected to INPUT X.

2) Switch MODE selector to PERIOD X.

3) Switch TIME selector to UNITS Y.

4) Set ATTEN FACTOR control to 100.

5) Connect signal to INPUT Y.

6) Rotate INPUT X TRIGGER control through its range until GATE OPEN light comes on.

7) Slowly turn TRIGGER control between its extreme positions, and note whether any counting occurs. If counting occurs, proceed to step 9; otherwise, continue on to step 8.

8) Repeat step 7, each time reducing the attenuation factor, i.e., 10, 1, until counting occurs. If no counting occurs in ATTEN "1", determine if an adequate input signal is present.

9) By turning the TRIGGER control, determine the positions which start and stop the counting, then set the control midway between these two positions.

10) Refer back to Mode of Operation section (Section 2.6) for further information on mode being used.

## 2.8 ACCURACY

Accuracy of a measurement depends on the sum of errors contributed from four sources: the gating action, the internal time standard, the input signal (that does not truly represent the event being measured), and the resolution of the instrument.

### 2.8.1 Error Due to Gating Action

Figure 2-14 shows how gating action may cause the indication to be in error as much as ±1 count. If the gate opens just before one clock pulse and closes immediately after another, the indication may be one time unit high. But if the gate opens just after a pulse and closes just before another, the indication may be one time unit low. In no case will the error be greater than one time unit. In TIM and PERIOD measurement, this error will be very slight if the time units chosen are small in comparison to the interval being timed.

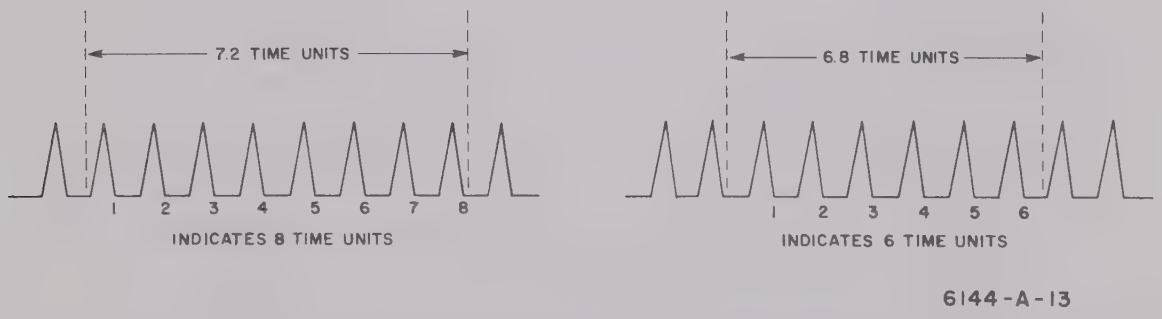



FIG. 2-14. Illustrates how gating action may cause an error of one time unit.

### 2.8.2 Error Due to Internal Time Standard

The internal time standard is a crystal oscillator housed in a thermostatically controlled chamber. The oscillator is subject to deviations from an absolute standard, and may change frequency during the interval between two calibrations. Once set, the oscillator will not vary more than 3 parts in $10^7$ per week. This means that measurements made within the same week can be compared with a maximum error of 0.00002 percent. If absolute (as distinguished from comparative) time is important, the oscillator may be periodically adjusted to correspond with the standard frequencies broadcast from the National Bureau of Standards radio stations, WWV or WWVH.

### 2.8.3 Error Due to a Non-Representative Input Signal

The instrument begins timing at the instant the input excursion passes through the trigger voltage level. If the input contains "noise (where noise is defined as any voltage variation not representative of the event being timed), the noise may cause the input voltage to reach the trigger level too early. Figure 2-15 shows what happens if the noise is a higher frequency imposed on the ideal input signal.

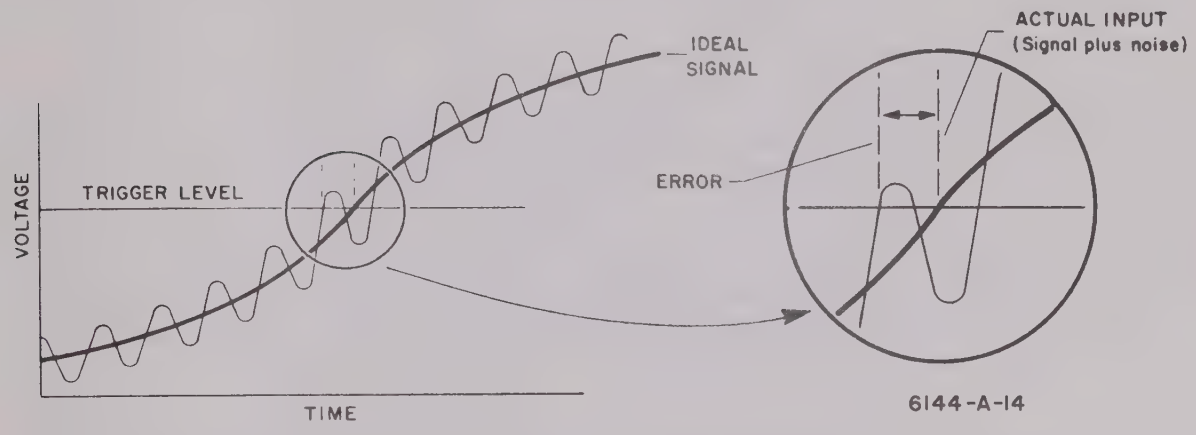



FIG. 2-15. Illustrates how noise may cause a timing error.

The best way to avoid error is to use a noise-free signal of the largest acceptable amplitude. A fast rise time will reduce the error greatly. Figure 2-16 shows that, given two voltage excursions will equal noise, the one with the faster rise time will cause less error.

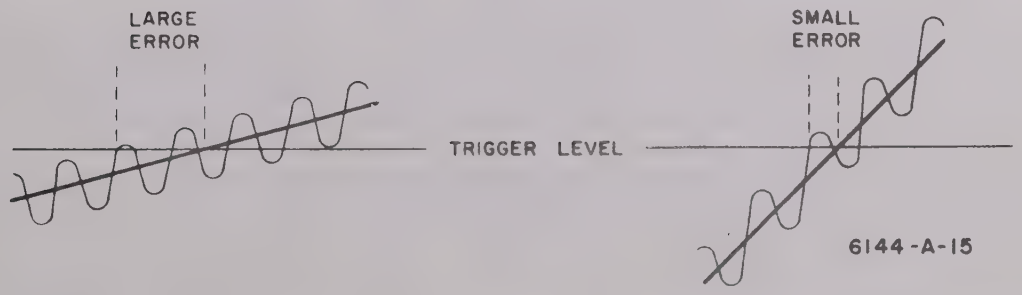



FIG. 2-16. Illustrates how reducing the rise time of a signal will reduce error due to noise.

The error due to noise can be calculated by the following formula:

$$t = \frac{E_n}{S}, \text{ where}$$

$t$ = maximum possible error in seconds

$E_n$ = peak-to-peak noise in volts

$S$ = slope (volts per second) of ideal signal at trigger point.

### 2.8.4 Resolution Error

The minimum time that must elapse between events if both are to be counted is called the resolution time of the instrument. This instrument has a resolution time of better than 0.4 microseconds for frequency measurements.

Resolution error becomes important when random events are counted. One such event may occur immediately after another, before the counting circuits are fully recovered and prepared to register it. The second event will not only fail to cause a count but its effect on the circuits may also cause a third event to fail to register.

## 2.9 AUXILIARY CONNECTORS

### 2.9.1 Digital Recorder Jack

This multi-terminal socket, wired to the readout lines of each storage binary, makes available 1-2-4-8 binary-coded signals for use with such auxiliary equipment as printers, display units, and data converters. Table 2-5 shows the binary code generated by the storage binaries for each decimal digit registered. A "0" means an output level of about -10 volts with respect to ground and with current limited to 0.2 ma; a "1" means a level at ground or -0.3 volts with respect to ground and with current limited to 5 ma. Table 2-6 lists the pin connections to each storage binary.

Pin 39 carries a control signal from the counter to the recorder. This pin is negative (-10 volts or more) for 50 ms, and at approximately ground potential from the time of reset until the next accessory command.

Pin 40 carries an "inhibit recycle" signal from the accessory to the counter. When this pin is grounded the instrument cannot recycle.

Pins 35 and 38 are grounded.

Pins 29 through 32 are not used.

Table 2-5

| FOUR-LINE BINARY CODE | | | | |
|---|---|---|---|---|
| DECIMAL DIGIT REGISTERED | First Binary Stage (Weight 1) | Second Binary Stage (Weight 2) | Third Binary Stage (Weight 4) | Fourth Binary Stage (Weight 8) |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

Use Table 2-5 to convert a coded digit to a decimal digit. Note the weight of each column in which a "1" appears, then sum the weights. For example, the coded digit "1100" is equivalent to 1+2+0+0 = 3; and "1001" is equivalent to 1+0+0+8 = 9.

Table 2-6

| | PIN NO. ON DIGITAL RECORDER SOCKET | | | |
|---|---|---|---|---|
| | First Binary Stage | Second Binary Stage | Third Binary Stage | Fourth Binary Stage |
| Highest order digit read | Pin 28 | Pin 27 | Pin 26 | Pin 25 |
| 2nd highest order digit | 4 | 3 | 2 | 1 |
| 3rd highest order digit | 8 | 7 | 6 | 5 |
| 4th highest order digit | 12 | 11 | 10 | 9 |
| 5th highest order digit | 16 | 15 | 14 | 13 |
| 6th highest order digit | 20 | 19 | 18 | 17 |
| 7th highest order digit | 24 | 23 | 22 | 21 |

## 2.9.2 TIME Jack

An output signal from the time-base generator is available at this jack. The signal is a +6 volt, 0.15 μsecond pulse in series with 3.3 kohms. These pulses are accurately spaced at the interval indicated by the TIME selector and, except when MODE selector is at TEST or E/UT X, can be used externally as a clock signal. See Figure 2-17.

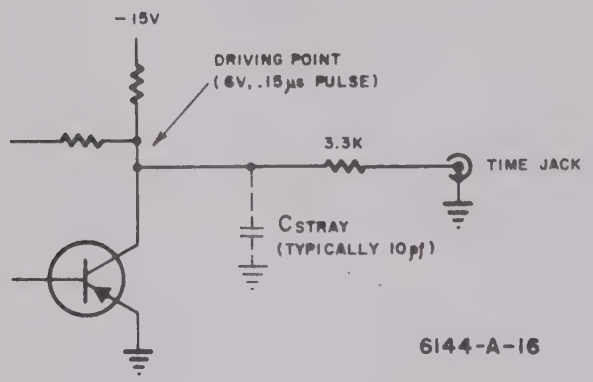



FIG. 2-17. Clock signal output circuit.

## 2.9.3 FREQ Jack

When the EXT-INT switch is at EXT, an external signal can be introduced at this jack to substitute for the oscillator signal. The external signal must be capable of producing 1 volt rms across 1 kΩ. Frequencies from 50 kc to 2.5 mc are suitable. Frequencies below 50 kc can be used if the internal coupling capacitor is paralleled by a suitable capacitor.

On INT, the oscillator frequency can be monitored.

NOTE

EXT/INT switch must be in INT position for operation of counter unless an external clock is used.

### 2.9.4 SCOPE Jack

This jack connects through a 15 kΩ resistor to the gate control binary. The voltage at the jack is at ground level when the gate is closed and -10 volts with respect to ground when the gate is open.

## 2.10 REMOTE PROGRAMMING

Upon request, the instrument can be modified at the factory to include a DPX-57 connector for remote programming. With this modification, external control is possible for the MODE, TIME, RECYCLE RATE controls, and the SLOPE switches.

# Section 3

SECTION 3

SERVICING

## 3.1 REGULATED POWER SUPPLY ADJUSTMENT

### 3.1.1 General

There are four adjustments to set the +90, +15, +10, and -15 volt regulated supplies. The +90, +15, and -15 volt adjustments are located on the regulator board and the +10 volt adjustment on the EL supply board. The two boards are located at the rear of the instrument next to the power transformer (see Figure 3-1).

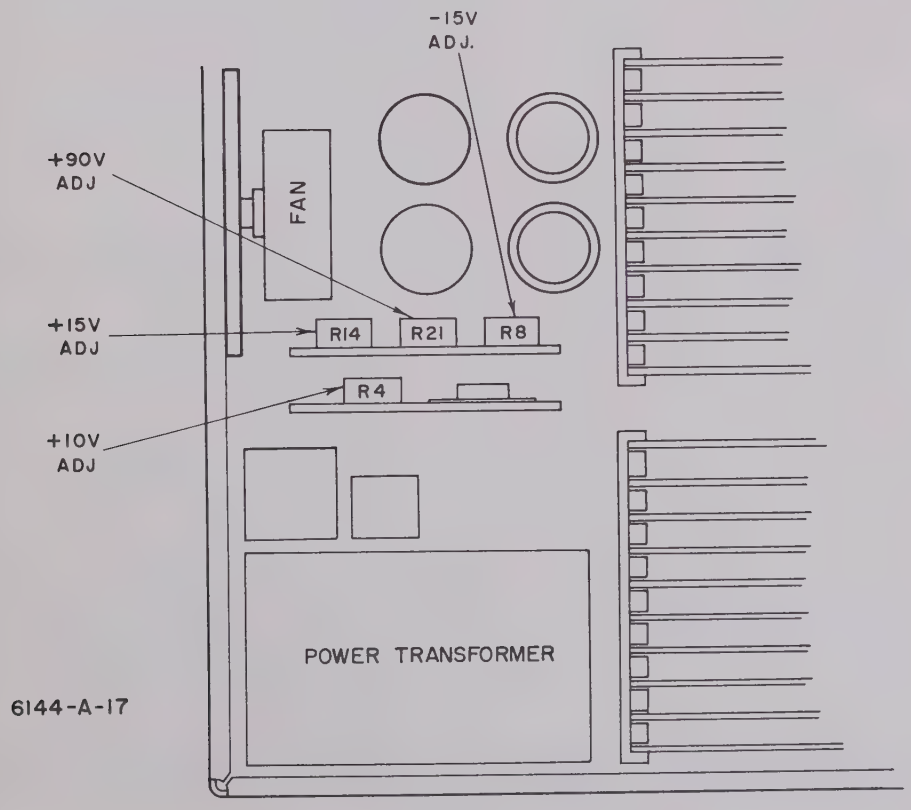



FIG. 3-1. Top view of chassis showing location of +90, +15, +10, and -15 volt adjustments.

### 3.1.2 Procedure

NOTE

> Do not remove the regulator board from its receptacle without first unplugging the ac line cord from its power source.

1) Use a voltmeter of at least 1% accuracy.

2) Voltage measurements are referenced to chassis ground. See Figure 3-2 for +90, +15, +10, and -15 volt test points.

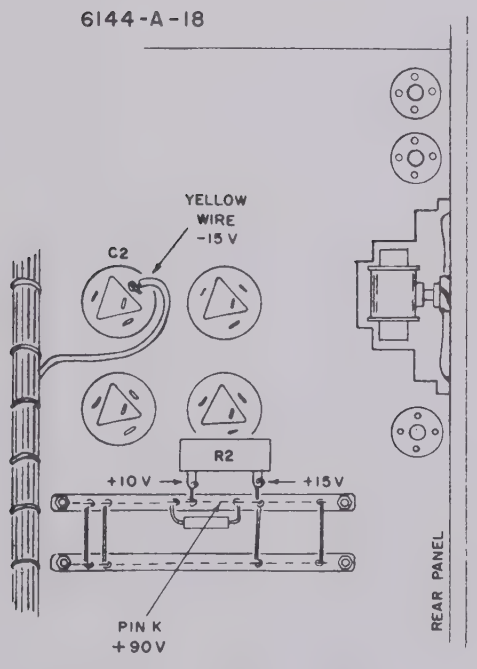



FIG. 3-2. Under chassis view showing location of +90, +15, +10, and -15 volt test points.

3) Remove regulator board from its receptacle. Insert extension board (supplied with instrument) into regulator board receptacle, and insert regulator board at the other end of extension board.

4) Adjust the (+90) potentiometer for +90 volts, ±0.1 volt (see Figures 3-1 and 3-2).

   Adjust the (+15) potentiometer for +15 volts, ±0.2 volt (see Figures 3-1 and 3-2).

   Adjust the (-15) potentiometer for -15 volts, ±0.2 volt (see Figures 3-1 and 3-2).

5) Remove extension board and return regulator board to its receptacle.

6) Remove EL supply board from its receptacle. Insert extension board into EL receptacle and plug EL supply board into other end of extension board.

7) Adjust the (+10) potentiometer for +10 volts, ±0.2 volt (see Figures 3-1 and 3-2).

8) Return EL supply board to its receptacle.

## 3.2 OSCILLATOR ADJUSTMENT

### 3.2.1 Procedure

Oscillator adjustments are seldom required. When necessary use this procedure:

1) Adjustment of C1

   a) Use Figure 3-3 to locate trimmer adjustment C1.

   b) Use an oscilloscope (such as Tektronix Model 531) of at least 10 megohms input impedance paralleled with approximately 15 pf; otherwise, loading may change the oscillator frequency.

   c) Connect the output from FREQ Jack J4 to the vertical input of the scope. Then, couple a 1 mc standard to the horizontal input and adjust C1 for a circular Lissajous pattern indicating equal frequencies.

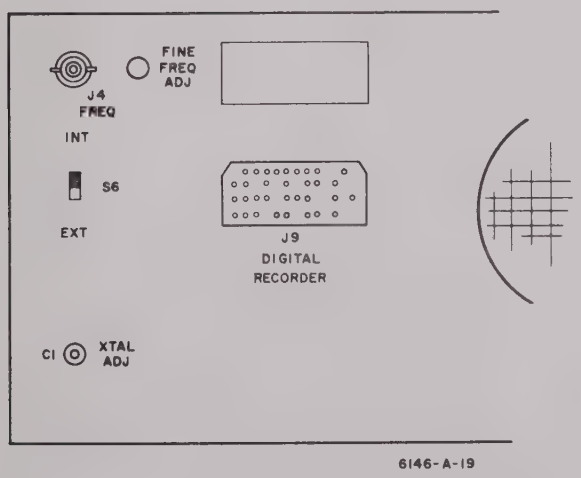



FIG. 3-3. Rear panel view showing location of Crystal Adjust (C1).

## 3.3 ATTENUATOR ADJUSTMENT

The ceramic trimmer capacitor on each attenuator assembly must be adjusted to prevent the attenuator from distorting the input signal.

### 3.3.1 Procedure

Refer to Figure 3-4 for location of trimmer adjustments. Equipment needed: Square Wave Generator (Tektronix Type or equivalent), and an Oscilloscope (Tektronix Type 581 or equivalent).

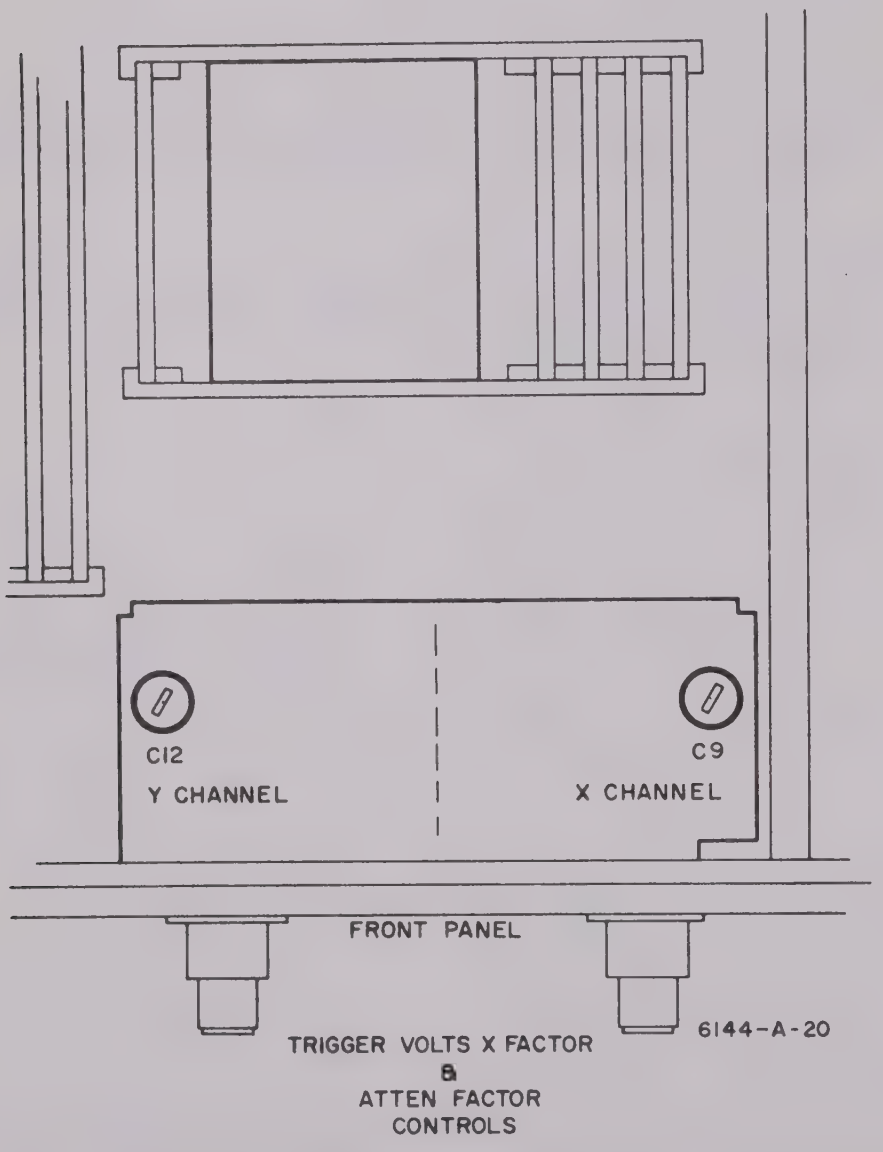



FIG. 3-4. Top view of chassis showing location of ATTEN Selector Frequency compensating capacitors.

1) Make sure both amplifier boards are in place.

2) Connect the Square Wave Generator to INPUT X. Terminate (at instrument) with a 50Ω resistor.

3) Set ATTEN Selector (INPUT X) to AC 10. Apply a 2v p-p, 10kc signal to the input.

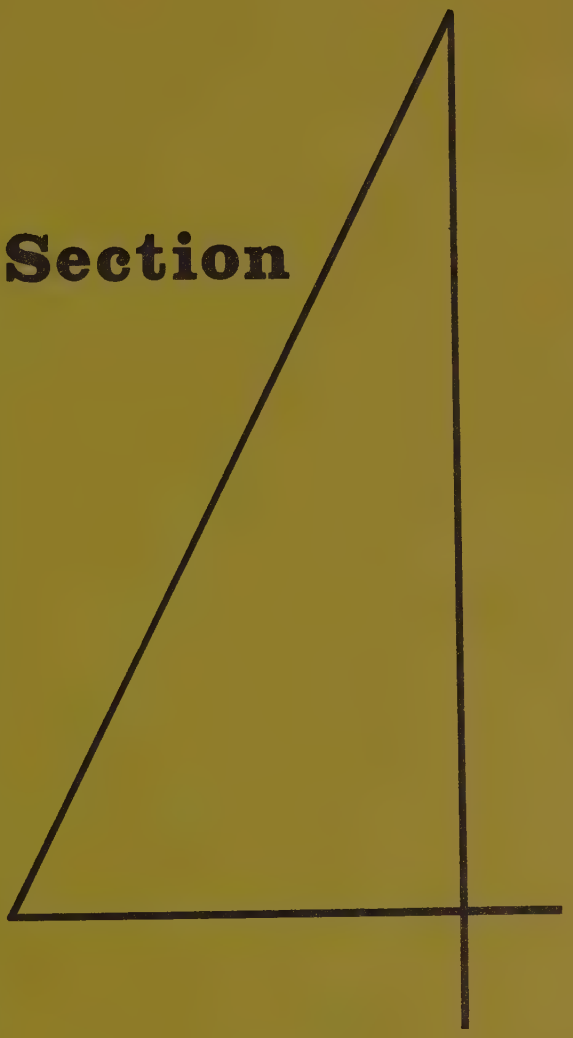
4) Monitor with an oscilloscope at pin A of XA18 (input X amplifier) the output of the attenuator. Adjust trimmer C9 for maximum flatness of the square wave.

5) Connect the Square Wave Generator to INPUT Y. Terminate (at instrument) with a 50Ω resistor.

6) Set ATTEN Selector (INPUT Y) to AC 10. Apply a 2v p-p, 10kc signal to the input.

7) Monitor with an oscilloscope at pin A of XA17 (input Y amplifier) the output of the attenuator. Adjust trimmer C12 for maximum flatness of the square wave.

# Section



## CONTENTS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| Option AA | 1 | Option AH | 3 |
| Option AB | 1 | Option A1 | 4 |
| Option AC | 2 | Option A2 | 4 |
| Option ACM | 2 | Option A3 | 4 |
| Option AD | 3 | Option A4 | 4 |
| Option AE | 3 | Option A5 | 4 |
| Option AF | 3 | Option A6 | 4 |
| Option AG | 3 | Option A7 | 4 |

Table 1. Available and Standard Options 5

Option AA Drawings and Parts Lists:
- 1 MHz Oscillator and Shaper Component Layout (A411676) 6
- 1 MHz Oscillator and Shaper Schematic (C411996) 6a
- 1 MHz Oscillator Assembly Schematic (B416235) 6b

Option AB Drawings and Parts Lists:
- 1 MHz Precision Oscillator Component Layout (A411757) 7
- Oscillator Buffer and Shaper Component Layout (A411759) 7
- 1 MHz Precision Oscillator Schematic (C412391) 7a
- Temperature Sensor Component Layout (B422710) 8
- Temperature Control Component Layout (B422713) 8
- Temperature Control, SCR Mode, Schematic (C422707) 8a

Option ACM Drawings and Parts List:
- 1 MHz Shaper and Divider Component Layout (C434690) 9
- 1 MHz Shaper and Divider Schematic (C434693) 9a
- 1 MHz Timing Module Schematic (C435437) 9b

Option AD Drawings and Parts List:
- Remote Program Component Layout (A421451) 10
- Remote Program Matrix Diagram (C418543) 10a
- Remote Unit Logic Schematic, 6126/44/46 - (D421974) 11a
- Remote Unit Logic Schematic, 6127/47 - (D418542) 12a

ADDENDUM A

## OPTION ACM - OSCILLATOR

For all 1 MHz Shaper & Divider boards stamped with revision letter "A-1".

1) To bring the schematic diagram (dwg. no. C434693-Rev. A) to revision level "A-1", change diodes CR1 and CR2 from part no. 755-431324 to part no. 755-430460.

   Change revision letter of the schematic diagram to "A-1".

2) Change the component layout (dwg. no. C434690-Rev. A) to revision letter "A-1" to agree with the assembly stamping.

3) Change the parts list for the 1 MHz Shaper and Divider board to agree with the above.

ADDENDUM B

## ACM OPTION

For all 1 MHz Shaper and Divider Boards stamped with revision letter "A-2":

1) To bring the schematic diagram (dwg. no. C434693-Rev. A-1) up to revision level "A-2",

   a) change R6 to 8.2K (part no. 601-822331).

   b) change R7 to 15K (part no. 601-822301).

   c) change R5 to 6.8K (part no. 601-822299).

   d) change Q3 to type 2N3638 (part no. 755-838105).

   Change the revision letter to "Rev. A-2".

2) Change the component layout drawing (no. C434690-Rev. A-1) and parts list to agree with the above.

# ADDENDUM C

## 6100 SERIES OPTIONS

### OPTION ACM

Make the following changes to drawing number C435437-Rev. A, on page 9b:

1) Remove connection from pin 2 (Oscillator, A767-435257) to ground.

2) Remove the wire from pin R (the one labelled "To Time Base Logic Board - pin L") and connect to pin N. Add series resistor R1 (68Ω, 1/4W, 5%; part number 601-823389) between pins N and R.

3) Change the revision letter to "Rev. B".

4) Change the revision letter to "Rev. B" for the following drawings:

   1 MHz Shaper & Divider Component Layout (p. 9) C434690-A (for Options ACL and ACM).

   1 MHz Shaper & Divider Schematic Diagram (p. 9a) C434693-A (for Options ACL and ACM).

5) Replace the parts list on the back of page 9 with the one on page 2 of this addendum.

### OPTION ACL

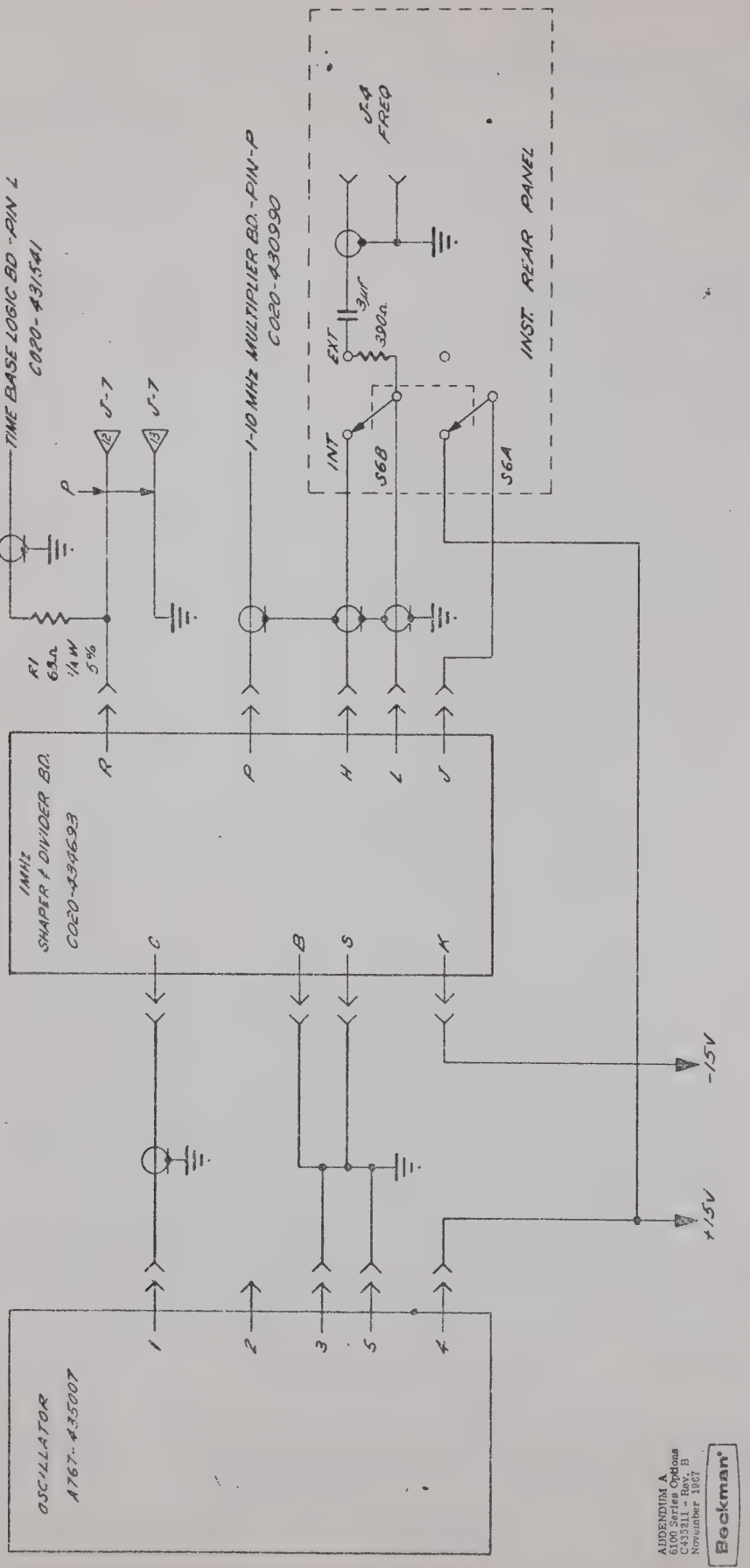
Add the attached drawing, Option ACL: 1 MHz Timing Module, (drawing number C435211-Rev. B), to your copy of the "6100 Series Options".

## 1 MHz SHAPER & DIVIDER BOARD

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | 887-434690-B | 1 MHz Shaper & Divider Assembly | Beckman | 1 |
| C1, 3, 4, 5, 6, 9, 10, 12, 14 | 633-804715 | Capacitor, F.Cerm., 0.01μf, 50V | Sprague 19C214A6 | 9 |
| C2 | 637-822757 | Capacitor, F.Mica, 1000pf, 100V, 5% | Electromotive DM15F102J0-100WV4CR | 1 |
| C7 | 637-822251 | Capacitor, F.Mica, 100pf, 500V, 5% | Electromotive DM15F101J0-500WV4CR | 1 |
| C8 | 637-825496 | Capacitor, F.Mica, 680pf, 300V, 5% | Electromotive DM15F681J0-300WV4CR | 1 |
| C11 | 637-825104 | Capacitor, F.Mica, 150pf, 500V, 5% | Electromotive DM15F151J0-500WV4CR | 1 |
| C13 | 637-819381 | Capacitor, F.Mica, 560pf, 300V, 5% | Electromotive DM15F561J0-300WV1CR | 1 |
| C15 | 633-815873 | Capacitor, F.Cerm., 0.33μf, 25V | Sprague 5C10A | 1 |
| CR1, 2 | 755-430460 | Diode, Special, Silicon | Beckman | 2 |
| CR3 | 755-402107 | Diode, Special | Beckman | 1 |
| L1 | 795-434743 | Inductor, Variable | Beckman | 1 |
| L2 | 795-827337 | Inductor, Fixed, 6.8μH, 10% | National NB-6.81 | 1 |
| Q1, 4, 7 | 755-419596 | Transistor, Special | Beckman | 3 |
| Q2, 5, 6 | 755-425735 | Transistor, Special | Beckman | 3 |
| Q3 | 755-838105 | Transistor, 2N3638 | Fairchild | 1 |
| R1, 2 | 601-822334 | Resistor, F.Comp., 22K, 1/4W, 5% | Allen Bradley CB2235 | 2 |
| R3, 15 | 601-817735 | Resistor, F.Comp., 100Ω, 1/4W, 5% | Allen Bradley CB1015 | 2 |
| R4, 12 | 601-822527 | Resistor, F.Comp., 1.5K, 1/4W, 5% | Allen Bradley CB1525 | 2 |
| R5 | 601-822299 | Resistor, F.Comp., 6.8K, 1/4W, 5% | Allen Bradley CB6825 | 1 |
| R6 | 601-822331 | Resistor, F.Comp., 8.2K, 1/4W, 5% | Allen Bradley CB8225 | 1 |
| R7 | 601-822301 | Resistor, F.Comp., 15K, 1/4W, 5% | Allen Bradley CB1535 | 1 |
| R8, 9 | 601-822324 | Resistor, F.Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 2 |
| R10, 23 | 601-823383 | Resistor, F.Comp., 22Ω, 1/4W, 5% | Allen Bradley CB2205 | 2 |
| R11 | 601-823395 | Resistor, F.Comp., 470Ω, 1/4W, 5% | Allen Bradley CB4715 | 1 |
| R13 | 601-822544 | Resistor, F.Comp., 1.8K, 1/4W, 5% | Allen Bradley CB1825 | 1 |
| R14 | 601-801803 | Resistor, F.Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 1 |
| R16, 20, 21, 22 | 601-822306 | Resistor, F.Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 4 |
| R17 | 601-822327 | Resistor, F.Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 1 |
| R18 | 601-822295 | Resistor, F.Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 1 |
| R19 | 601-822326 | Resistor, F.Comp., 1.2K, 1/4W, 5% | Allen Bradley CB1225 | 1 |

## MISCELLANEOUS PARTS
### 1 MHz Timing Module

| | | | | |
|---|---|---|---|---|
| R1 | 601-823389 | Resistor, F.Comp., 68Ω, 1/4W, 5% | Allen Bradley CB6805 | 1 |




OPTION ACL
1 MHz TIMING MODULE SCHEMATIC DIAGRAM

ADDENDUM A
6100 Series Options
C433211 - Rev. B
November 1967

Beckman®

# MODEL 6100 SERIES OPTIONS

*NOTE*

*Each 6100 Series option is briefly described below. Applicable assembly drawings (with parts lists) and schematic diagrams are located at the end of the writeup.*

*Table 1 lists the options that are available and standard for each instrument.*

## OPTION AA

This option substitutes a medium-stability oscillator (3 parts in $10^7$ per week) for the precision oscillator (2 parts in $10^8$ per week average).

Specifications for the medium-stability oscillator are as follows:

OPTION AA SPECIFICATIONS

| | |
|---|---|
| Frequency: | 1 MHz |
| Stability: | 3 parts in $10^7$ per week with ±10% line variation and ±10 degrees C temperature variation. |

OPTION AA DRAWINGS

| | Dwg. No. | Page |
|---|---|---|
| 1 MHz Oscillator and Shaper Component Layout | A411676 | 6 |
| 1 MHz Oscillator and Shaper Schematic | C411996 | 6a |
| 1 MHz Oscillator Assembly Schematic | B416235 | 6b |

## OPTION AB

In instruments with Option AB, a high-stability oscillator (2 parts in $10^8$ per week average) replaces the medium-stability oscillator.

Specifications for the high-stability oscillator are as follows:

OPTION AB SPECIFICATIONS

| | |
|---|---|
| Frequency: | 1 MHz |
| Stability<br>Short Term: | Less than 3 parts in $10^9$ per 24 hours average;<br>Less than 1 part in $10^9$ standard deviation. |
| Long Term: | Less than 2 parts in $10^8$ per week average;<br>Less than 5 parts in $10^9$ standard deviation. |
| Frequency vs. Ambient Temp: | Less than 2 parts in $10^{10}$ per degree C over the range -20°C to +55°C. |

OPTION AB DRAWINGS

| | Dwg. No. | Page |
|---|---|---|
| 1 MHz Precision Oscillator Component Layout | A411757 | 7 |
| Oscillator Buffer and Shaper Component Layout | A411759 | 7 |
| 1 MHz Precision Oscillator Schematic | C412391 | 7a |
| Temperature Sensor Component Layout | B422710 | 8 |
| Temperature Control Component Layout | B422713 | 8 |
| Temperature Control, SCR Mode, Schematic | C422707 | 8a |

## OPTION AC

The AC Oscillator is an increased stability version of the AB unit. (Note that the oscillator circuitry is identical to that used in Option AB.)

Specifications for this oscillator are as follows:

OPTION AC SPECIFICATIONS

| Frequency: | 1 MHz |
|---|---|
| Stability | |
| Short Term: | Less than 3 parts in $10^9$ per 24 hours. |
| Long Term: | Less than 2 parts in $10^8$ per week. |
| Frequency vs. Ambient Temp: | Less than 8 parts in $10^9$ per degree C over the range -20°C to +60°C. |

## OPTION ACM

Option ACM (Timing Module) offers an ultra-high stability oscillator with excellent retrace characteristics in a fast warm-up oven.

Specifications for the Timing Module are as follows:

OPTION ACM SPECIFICATIONS

| Frequency | 1 MHz |
|---|---|
| Stability | |
| Short Term: | Less than 8 parts in $10^{10}$ of the average frequency when 1000 continuous measurements are made with one second averaging periods under constant environmental and voltage conditions. |
| Long Term: | Less than 1 part in $10^9$ per 24 hours after 72 hours of uninterrupted application of power under constant environmental and voltage conditions. Typically, less than 1 part in $10^9$ per hour after 1 hour of uninterrupted application of power. |
| Frequency vs. Ambient Temp: | Less than 2 parts in $10^{10}$ per degree C over the range -20°C to +65°C. |
| Frequency vs. Line Voltage: | Less than 5 parts in $10^{10}$ for a ±10% change from 115 volt, 60 Hz normal line voltage. |

Associated with the ACM Timing Module is a 1 MHz Shaper and Divider board, part number 887-434690.

OPTION ACM DRAWINGS

| | Dwg. No. | Page |
|---|---|---|
| 1 MHz Shaper and Divider Board Component Layout | C434690 | 9 |
| 1 MHz Shaper and Divider Board Schematic | C434693 | 9a |
| 1 MHz Timing Module Schematic | C435437 | 9b |

## OPTION AD

Instruments with Option AD have a DPX-57 rear-panel connector with mating plug for remote programming. With this option, external control is possible for the MODE, TIME, RECYCLE RATE, RESET, and SLOPE controls.

OPTION AD DRAWINGS

| | Dwg. No. | Page |
|---|---|---|
| Component Assembly | A421451 | 10 |
| Remote Matrix Diagram (6126/27/44/46/47) | C418543 | 10a |
| Schematic (6126/44/46) | D421974 | 11a |
| Schematic (6127/47) | D418542 | 12a |

A Model 6100 Series instrument can be programmed with either contact closures or transistor switching. However, if the instrument is used with a plug-in (other than Basic Plug-in) contact closures must be used. If transistor switching is desired, contact the factory.

## OPTION AE

This option provides 20-inch travel slides (3 sec., 50 lbs) for rack mounting (part number 307-827601).

## OPTION AF

Option AF permits the instrument to be used with a 400 Hz rather than the standard 60 Hz power source. Except for the replacement of the 60 Hz fan motor with a 400 Hz motor, there are no circuit changes.

## OPTION AG

With this option, front-panel connectors for INPUT X and INPUT Y are paralleled with connectors on the rear panel. This option applies to the basic instrument only and is not available on plug-in modules.

## OPTION AH

Instruments with Option AH have a 222 volt instead of the standard 117 volt primary. Figure 1 shows the AH Option.

The 222 volt transformer can be converted to 117 volt operation by rewiring as shown in Figure 2.

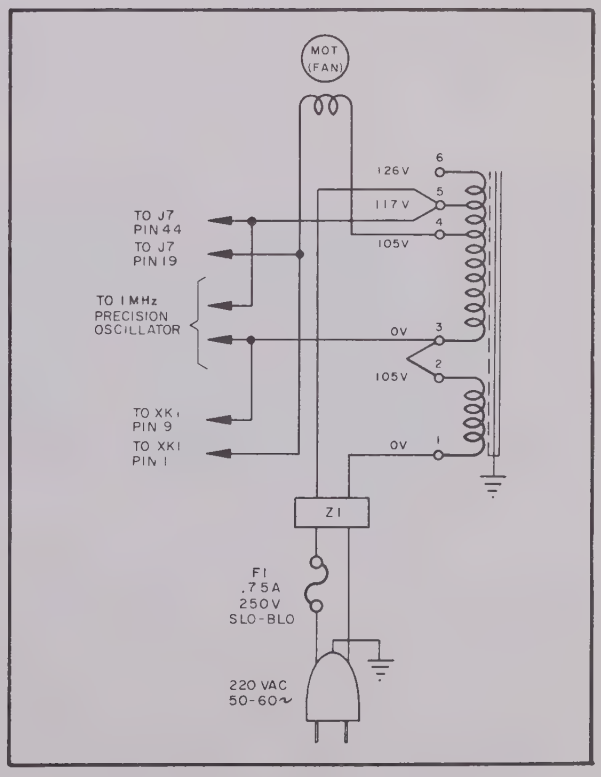



*FIG. 1. 222 Volt Primary.*

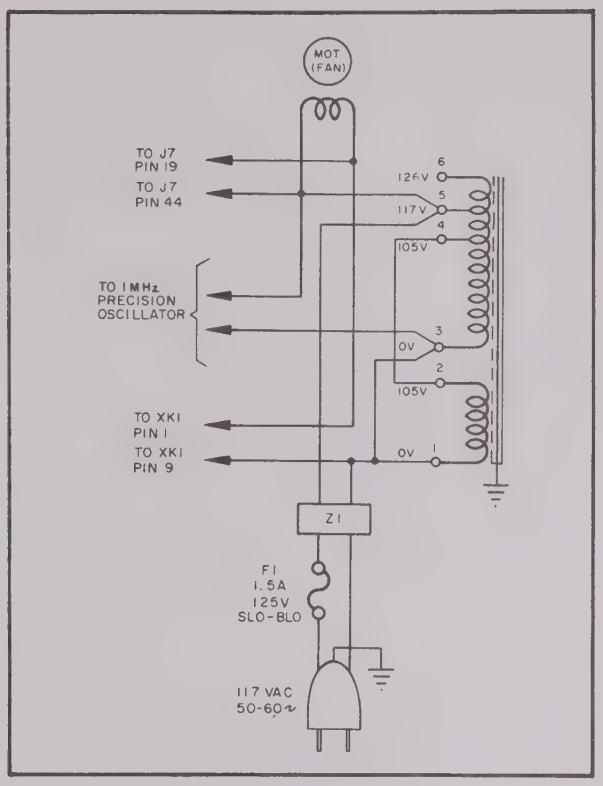



*FIG. 2. 117 Volt Primary.*

## OPTION A1

Option A1 provides a digital recorder output connector (40-pin J9: part number 672-806833, Cannon DPX40-34S) at the rear of the instrument. This multi-terminal socket, wired to the readout lines of each storage binary, makes available 1-2-4-8 binary-coded signals for use with such auxiliary equipment as printers, display units, and data converters.

## OPTION A2

Instruments with this option have a 10-second time base position on the TIME selector. Addition of a Model 850 Decimal Counting Unit to the time base divider chain provides this 10-second time base.

## OPTION A3

One additional digit of visual, storage, and readout BCD capability is provided with this option.

## OPTION A4

Two additional digits of visual, storage, and readout BCD capability is provided with this option.

## OPTION A5

Option A5 provides for special paint or front panels.

## OPTION A6

This option deletes the blank plug-in (Model 696), rack ears, and extender boards. A front-panel plate is also supplied.

## OPTION A7

Option A7 removes SCR Data Storage (DSU) boards and replaces them with Photoelectric Data Storage Units.

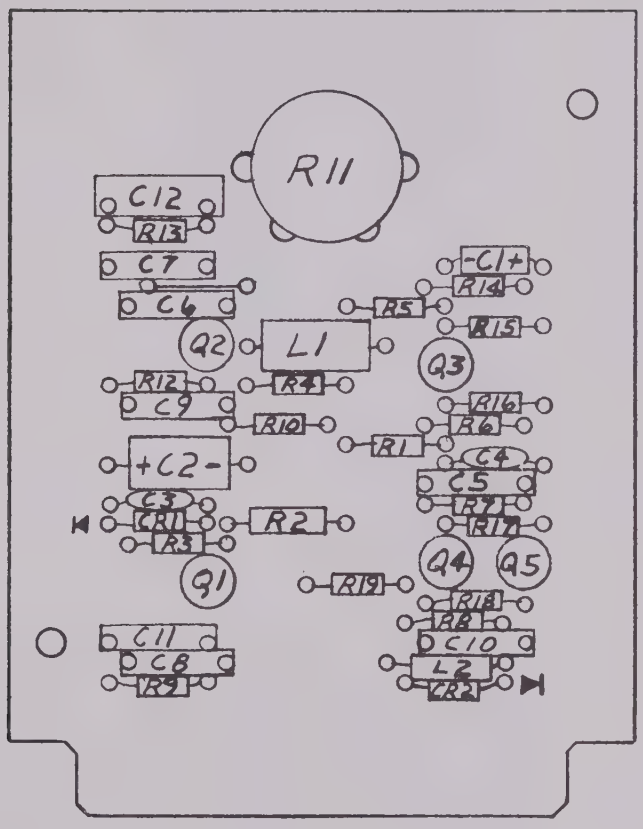
**TABLE 1**

| OPTION | MODEL NUMBER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 6120 | 6121 | 6122 | 6126 | 6127 | 6144 | 6145 | 6146 | 6147 | 6148 |
| AA | | | | * | * | | * | * | * | * |
| AB | * | * | * | | | * | // | | | // |
| AC | * | * | * | * | * | * | | * | * | |
| ACM | * | * | * | * | * | * | * | * | * | * |
| AD | // | // | // | * | * | * | * | * | * | * |
| AE | * | * | * | * | * | * | * | * | * | * |
| AF | * | * | * | * | * | * | * | * | * | // |
| AG | * | * | * | * | * | * | * | * | * | * |
| AH | * | * | * | * | * | * | * | * | * | * |
| A1 | * | * | * | | | | | | | |
| A2 | * | * | * | | | | | | | |
| A3 | * | * | * | | | * | | | | |
| A4 | * | * | * | | | // | | | | |
| A5 | * | * | * | * | * | * | * | * | * | * |
| A6 | * | * | | * | * | * | * | * | * | |
| A7 | * | * | // | * | * | * | // | * | * | // |

Standard for the instrument

* Available as an option

// Not available




OPTION AA
1 MHz OSCILLATOR AND SHAPER
COMPONENT LAYOUT

## 1 MHz OSCILLATOR BOARD

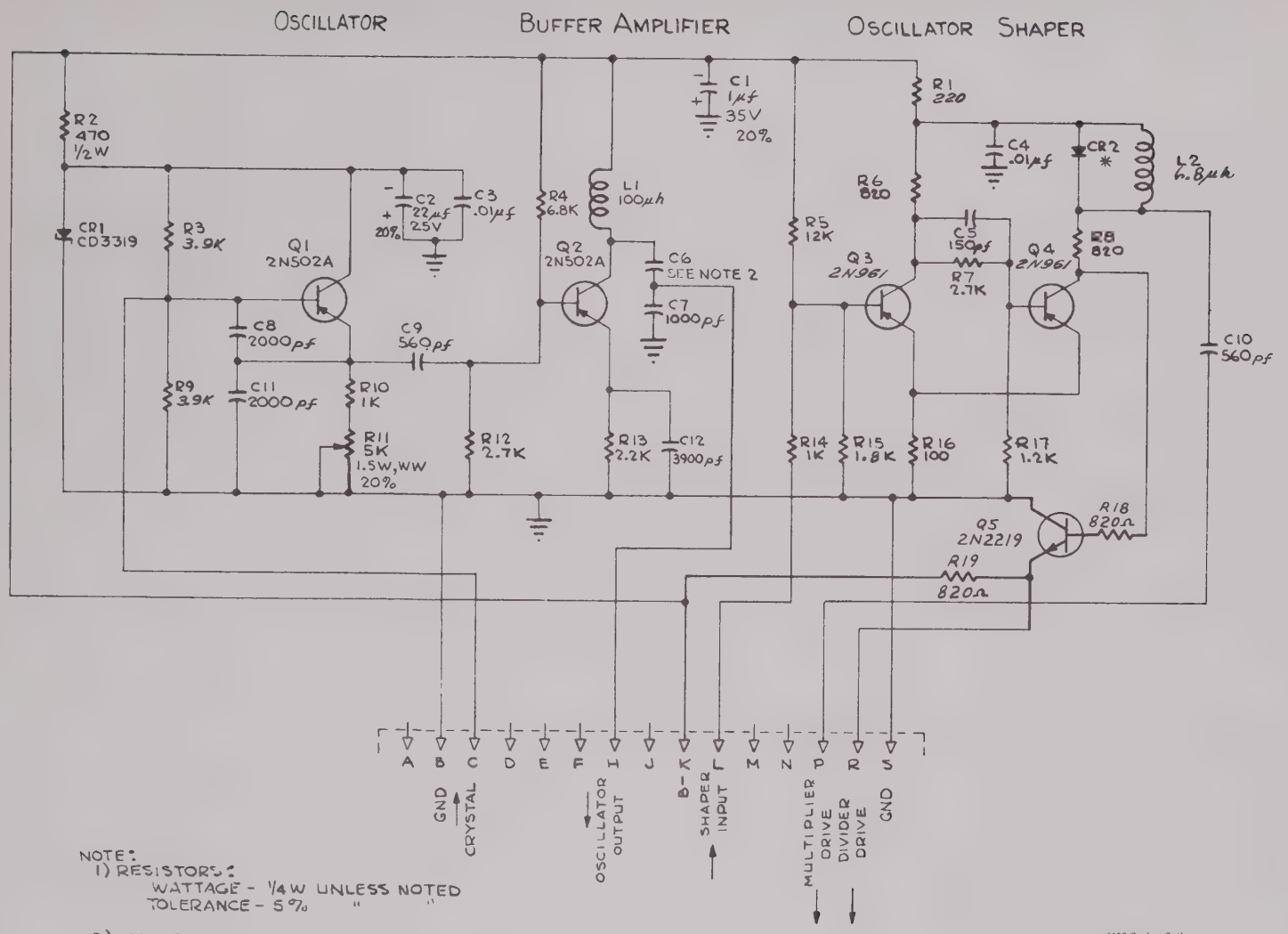
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | 887-411676 | 1 MHz Oscillator Board | Beckman | 1 |
| C1 | 631-814053 | Capacitor, F. Elect., 1μf, 35V, 20% | Sprague 150D105X0035A2 | 1 |
| C2 | 631-802980 | Capacitor, F. Elect., 22μf, 25V, 20% | Sprague 109D226X0025C2 | 1 |
| C3, 4 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 2 |
| C5 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Arco DM16E151J-300 | 1 |
| C6 | 637-824302 | Capacitor, F. Mica, 300pf, 300V, 5% | Arco DM16E301J-300 | 1 |
| C7 | 637-824028 | Capacitor, F. Mica, 1000pf, 300V, 5% | Arco DM16E102J-300 | 1 |
| C8, 11 | 637-824301 | Capacitor, F. Mica, 2000pf, 300V, 5% | Arco DM20F202-300 | 2 |
| C9, 10 | 637-824025 | Capacitor, F. Mica, 560pf, 300V, 5% | Arco DM16E561J-300 | 2 |
| C12 | 637-824303 | Capacitor, F. Mica, 3900pf, 300V, 5% | Arco DM20F392-300 | 1 |
| CR1 | 755-811280 | Diode, Reference, Sil., 5V min, 5.5V max. | Cont. Devic. CD3319 | 1 |
| CR2 | 755-402107 | Diode, Special | Beckman | 1 |
| L1 | 795-807904 | Inductor, Fixed, R. F., 0.100 mH | National RA-100-P | 1 |
| L2 | 795-827337 | Inductor, Fixed, R. F., 0.0068 mH | National NB6.8I | 1 |
| Q1, 2 | 755-817216 | Transistor, Germanium, PNP, 75mw max. | Philco 2N502A | 2 |
| Q3, 4 | 755-817811 | Transistor, Germanium, PNP, 150mw | Motorola 2N961 | 2 |
| Q5 | 755-823113 | Transistor, Silicon, NPN, 800mw max. | Motorola 2N2219 | 1 |
| R1 | 601-822327 | Resistor, F. Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 1 |
| R2 | 601-015446 | Resistor, F. Comp., 470Ω, 1/2W, 5% | Allen Bradley EB4715 | 1 |
| R3, 9 | 601-822460 | Resistor, F. Comp., 3.9K, 1/4W, 5% | Allen Bradley CB3925 | 2 |
| R4 | 601-822299 | Resistor, F. Comp., 6.8K, 1/4W, 5% | Allen Bradley CB6825 | 1 |
| R5 | 601-801803 | Resistor, F. Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 1 |
| R6, 8 | 601-822306 | Resistor, F. Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 2 |
| R7, 12 | 601-822295 | Resistor, F. Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 2 |

. . . continued

## 1 MHz OSCILLATOR BOARD - continued

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| R10, 14 | 601-822308 | Resistor, F. Comp., 1K, 1/4W, 5% | Allen Bradley CB1025 | 2 |
| R11 | 611-812859 | Resistor, V. WW, 5K, 1-1/2W, 20% | C. T. S. Series 111 | 1 |
| R13 | 601-822328 | Resistor, F. Comp., 2.2K, 1/4W, 5% | Allen Bradley CB2225 | 1 |
| R15 | 601-822544 | Resistor, F. Comp., 1.8K, 1/4W, 5% | Allen Bradley CB1825 | 1 |
| R16 | 601-817735 | Resistor, F. Comp., 100Ω, 1/4W, 5% | Allen Bradley CB1015 | 1 |
| R17 | 601-822326 | Resistor, F. Comp., 1.2K, 1/4W, 5% | Allen Bradley CB1225 | 1 |
| R18, 19 | 601-822306 | Resistor, F. Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 2 |
| | 864-412958 | Pad, Convertor Transistor | Beckman | 5 |

OPTION AA
1 MHz OSCILLATOR AND SHAPER
SCHEMATIC DIAGRAM




NOTE:
1) RESISTORS:
WATTAGE - 1/4W UNLESS NOTED
TOLERANCE - 5% " "

2) C6 NOMINALLY 300pf. IF OSCILLATOR OUTPUT IS LESS THAN 3V PP, CHANGE TO 330pf

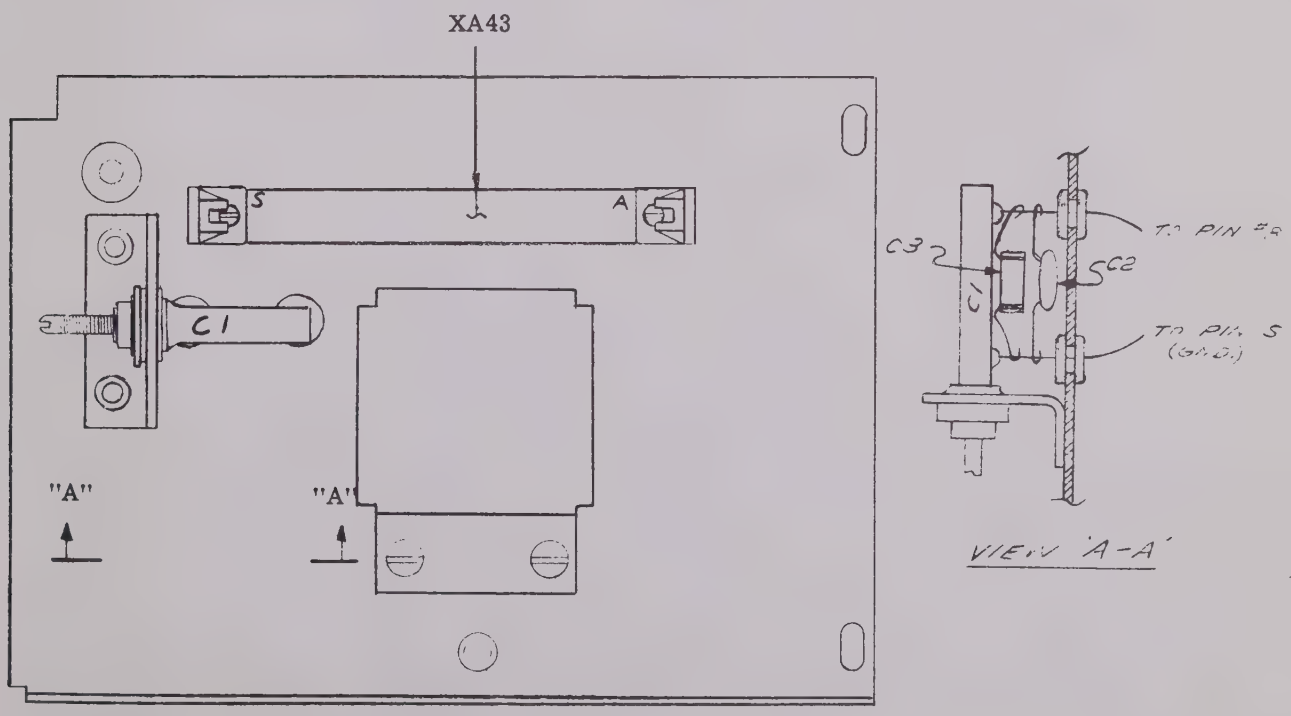
3) CAPACITORS:
TOLERANCE - 5% UNLESS NOTED
VOLTAGE - 300V " "

4) .01µf DISC ARE -20+80%, 500V

* 5) CR2 IS BDB #755-402107

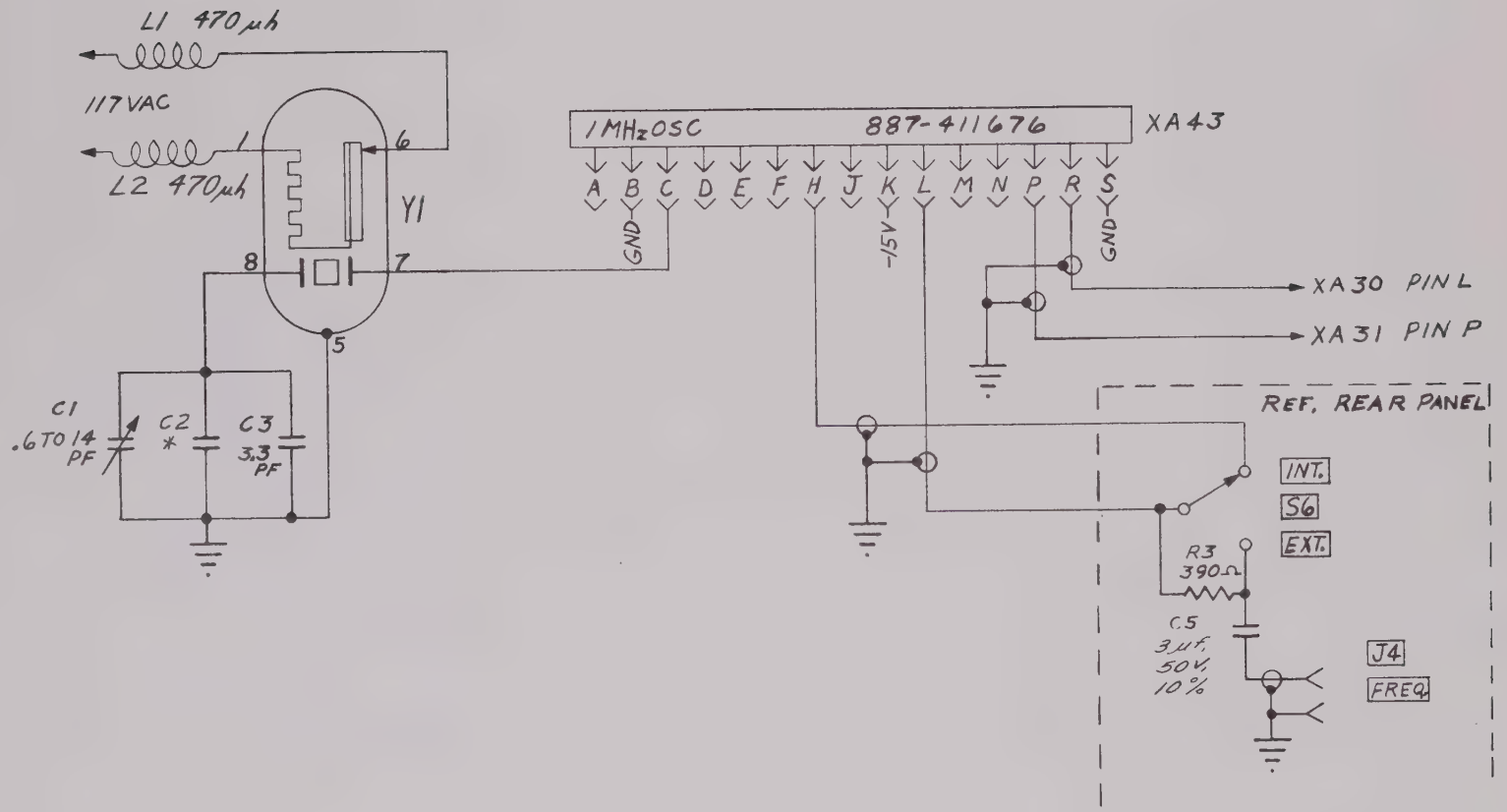
# 1 MHz OSCILLATOR ASSEMBLY

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C1 | 655-824658 | Capacitor, V. Glass, 0.6-14pf, 1000V, -40 to +50 PPM/°C | J. F. D. Elect., VC11GRA (Mod) | 1 |
| C2 | 633-804670 | Capacitor, 27pf, 600V, 5% | Erie NPO 332-270J | 1 |
| C3 | 633-827603 | Capacitor, F. Cerm., 3.3pf, T. C. -750 PPM/°C | Centralab TCN-3R3 | 1 |
| C5 | 639-835127 | Capacitor, F. Paper, 3μf, 50V, 10% | Elpac VX5A305K | 1 |
| J4 | 670-806738 | Connector, Coaxial, Receptacle, BNC Type | Amphenol UG-1094/U | 1 |
| L1, 2 | 795-807919 | Inductor, F. RF, 0.470μH, 9Ω, 285 MA | Delevan 3500-24 | 2 |
| R3 | 601-822371 | Resistor, F. Comp., 390Ω, 1/4W, 5% | Allen Bradley CB3915 | 1 |
| S6 | 716-827410 | Switch, Slide, DPDT | Continental Type 126 (C-W) | 1 |
| XA43 | 680-823481 | P. C. Connector, 15 Contacts | Cinch 250-15-70-170 | 1 |
| XY1 | 860-802333 | Socket, Tube, 8-Pin Saddle Mounting | Cinch 16203 (P/O 40-415714) | 1 |
| Y1 | 881-430340 | Crystal and Oven Assembly | Beckman | 1 |
| | 430-415711 | Chassis Oscillator | Beckman | 1 |
| | 864-415712 | Insulator, Oven Clamp Bracket | Beckman | 1 |




(C415715-D)

OPTION AA
1 MHz OSCILLATOR ASSEMBLY
SCHEMATIC DIAGRAM






6100 Series Options
B-416235 - Rev. F
June 1967

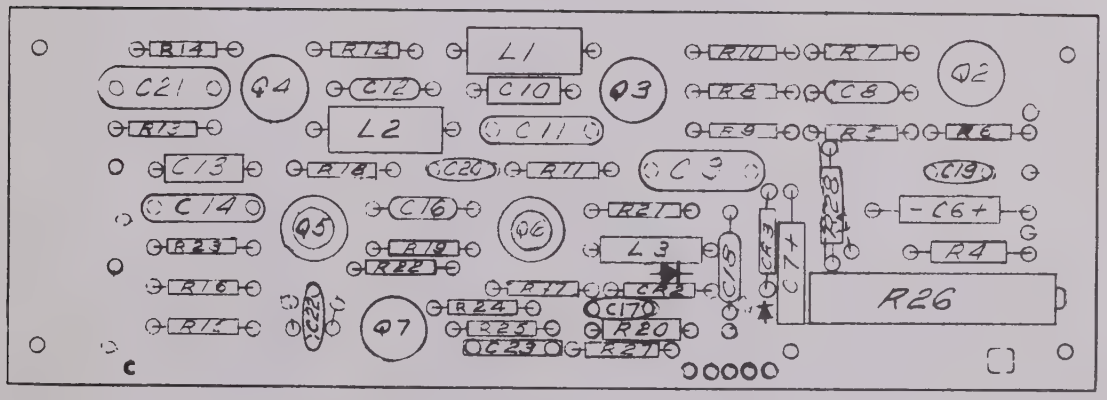
Beckman

Wire Side

Component Side

OPTION AB
1 MHz PRECISION OSCILLATOR
COMPONENT LAYOUT






OPTION AB
OSCILLATOR BUFFER AND SHAPER COMPONENT LAYOUT

## 1 MHz PRECISION OSCILLATOR BOARD*

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | 855-423561 | 1MHz Precision Oscillator Board | Beckman | 1 |
| C1 | 655-824658 | Capacitor, V. Glass, 0.6-14pf, 1000V | JFD Elect. VC11GRA-DL | 1 |
| C2 | 633-824491 | Capacitor, F. Cerm., NPO, 39pf, 600V, 10% | Skottie TCD-5-NPO | 1 |
| C3 | 637-819380 | Capacitor, F. Mica, 150pf, 300V, 5% | Elmenco DM15F151-300 | 1 |
| C4 | 637-824825 | Capacitor, F. Mica, 3000pf, 300V, 5% | Elmenco DM19F302-300 | 1 |
| C5 | 637-819381 | Capacitor, F. Mica, 560pf, 300V, 5% | Elmenco DM15F561-300 | 1 |
| CR1 | 755-811280 | Diode, Reference, Sil., 5.5V, Zener | Cont. Devic. CD3319 | 1 |
| Q1 | 755-823113 | Transistor, Type 2N2219 | Motorola 2N2219 | 1 |
| R1, 2 | 601-822324 | Resistor, F. Comp., 10K, | Allen Bradley CB1035 | 2 |
| R3 | 601-822397 | Resistor, F. Comp., 5.6K, 1/4W, 5% | Allen Bradley CB5625 | 1 |

## OSCILLATOR BUFFER & SHAPER BOARD*

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | | Oscillator Buffer & Shaper Board | Beckman | 1 |
| C6, 7 | 631-802980 | Capacitor, F. Elect., 22$\mu$f, 25V, $\pm$20% | Sprague 109D226X0025C2 | 2 |
| C8, 12, 18 | 637-824025 | Capacitor, F. Mica, 560pf, 300V, 5% | Elmenco DM16E561J-300 | 3 |
| C9, 21 | 637-824303 | Capacitor, F. Mica, 3900pf, 300V, 5% | Elmenco DM20F392-300 | 2 |
| C10 | 637-824022 | Capacitor, F. Mica, 330pf, 300V, 5% | Elmenco DM16E301J-300 | 1 |
| C11, 14 | 637-824028 | Capacitor, F. Mica, 1000pf, 300V, 5% | Elmenco DM16E102J-300 | 2 |
| C13 | 637-836918 | Capacitor, F. Mica, 360pf, 300V, 5% | Elmenco DM16E360J-300 | 1 |
| C16 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Elmenco DM16E151J-300 | 1 |
| C17, 19, 20, 22 | 633-804715 | Capacitor, F. Ceramic, 0.01$\mu$f, 50V | Sprague 19C214 | 4 |
| C23 | 633-815873 | Capacitor, F. Ceramic, 0.33$\mu$f, 25V | Sprague 5C10A | 1 |
| CR2 | 755-402107 | Diode, Germanium, Special | Beckman | 1 |
| CR3 | 755-828977 | Diode, Zener, 10V, 400ma, 5% | Motorola 1N758A | 1 |

*Part of 1MHz Precision Oscillator Assembly (Part number 855-423561)

. . . continued

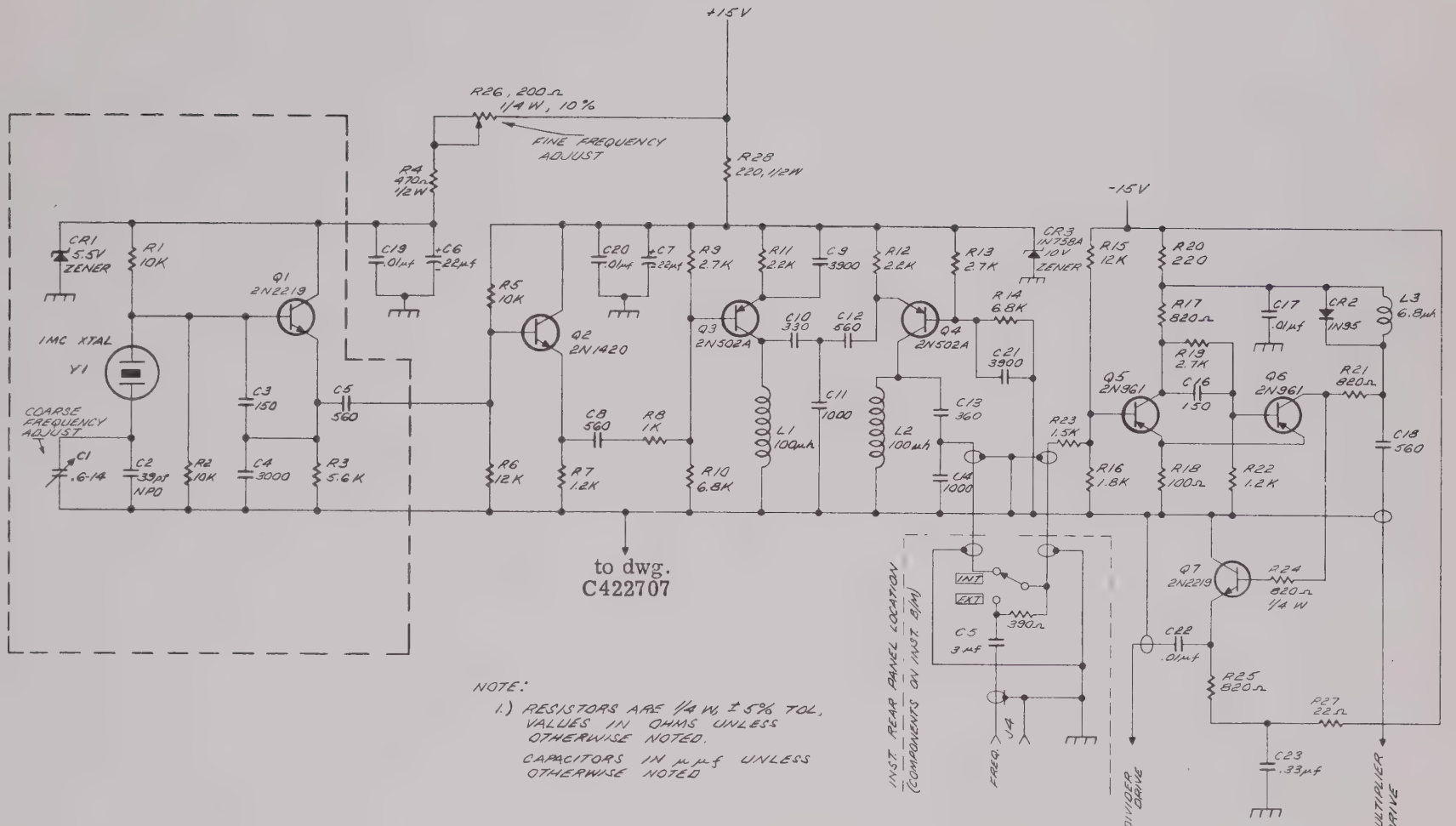
## OSCILLATOR BUFFER & SHAPER BOARD - continued

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| L1, 2 | 795-807904 | Inductor, Fixed R.F., 100mh | National RA-100-P | 2 |
| L3 | 795-827337 | Coil, 6.8μh, ±10%, 0.40Ω max. | Nat'l Coil NB6.81 | 1 |
| Q2 | 755-817964 | Transistor, Type 2N1420 | P.S.I. 2N1420 | 1 |
| Q3, 4 | 755-817216 | Transistor | Philco 2N502A | 2 |
| Q5, 6 | 755-817811 | Transistor | Motorola 2N961 | 2 |
| Q7 | 755-823113 | Transistor, Type 2N2219 | Motorola 2N2219 | 1 |
| R4 | 601-015446 | Resistor, F.Comp., 470Ω, 1/2W, 5% | Allen Bradley EB4715 | 1 |
| R5 | 601-822324 | Resistor, F.Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 1 |
| R6, 15 | 601-801803 | Resistor, F.Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 2 |
| R7, 22 | 601-822326 | Resistor, F.Comp., 1.2K, 1/4W, 5% | Allen Bradley CB1225 | 2 |
| R8 | 601-822308 | Resistor, F.Comp., 1K, 1/4W, 5% | Allen Bradley CB1025 | 1 |
| R9, 13, 19 | 601-822295 | Resistor, F.Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 3 |
| R10, 14 | 601-822299 | Resistor, F.Comp., 6.8K, 1/4W, 5% | Allen Bradley CB6825 | 2 |
| R11, 12 | 601-822328 | Resistor, F.Comp., 2.2K, 1/4W, 5% | Allen Bradley CB2225 | 2 |
| R16 | 601-822544 | Resistor, F.Comp., 1.8K, 1/4W, 5% | Allen Bradley CB1825 | 1 |
| R17, 21, 24, 25 | 601-822306 | Resistor, F.Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 4 |
| R18 | 601-817735 | Resistor, F.Comp., 100Ω, 1/4W, 5% | Allen Bradley CB1015 | 1 |
| R20 | 601-822327 | Resistor, F.Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 1 |
| R23 | 601-822527 | Resistor, F.Comp., 1.5K 1/4W, 5% | Allen Bradley CB1525 | 1 |
| R26 | 611-806216 | Resistor, V. WW, 200Ω, 10%, 1/4W | Bourns 275-1-201 | 1 |
| R27 | 601-823383 | Resistor, F.Comp., 22Ω, 1/4W, 5% | Allen Bradley EB2225 | 1 |
| R28 | 601-022939 | Resistor, F.Comp., 220Ω, 1/2W, 5% | Allen Bradley EB2215 | 1 |

### MISCELLANEOUS PARTS

| | | | | |
|---|---|---|---|---|
| XY1 | 680-413787 | Socket | Beckman | 1 |
| Y1 | 881-405017 | Crystal, Piezoelectric | Beckman | 1 |

OPTION AB
1 MHz PRECISION OSCILLATOR
SCHEMATIC DIAGRAM




NOTE:

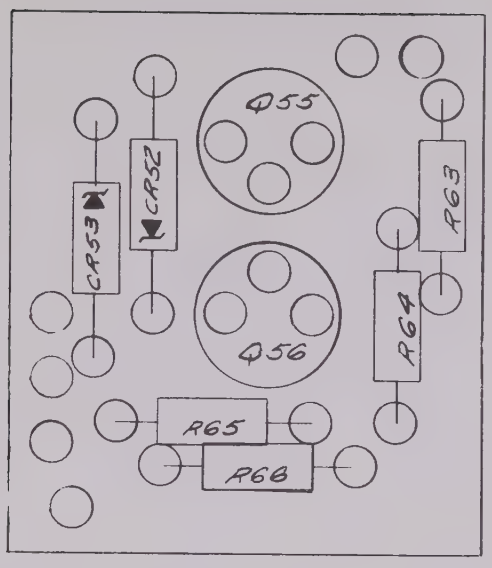
1.) RESISTORS ARE 1/4 W, ± 5% TOL, VALUES IN OHMS UNLESS OTHERWISE NOTED.

CAPACITORS IN μμf UNLESS OTHERWISE NOTED



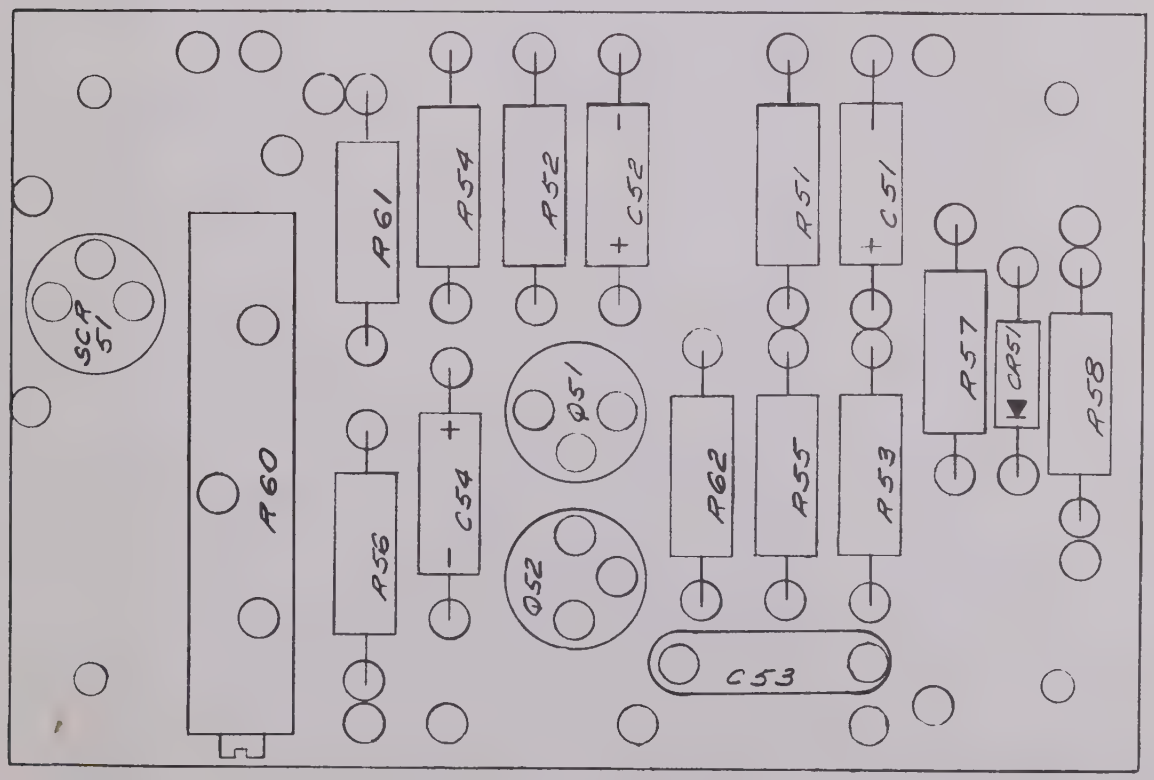


Beckman®




OPTION AB
TEMPERATURE SENSOR BOARD
COMPONENT LAYOUT






OPTION AB
TEMPERATURE CONTROL BOARD COMPONENT LAYOUT

## TEMPERATURE SENSOR BOARD*

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | | Temperature Sensor Board | Beckman | 1 |
| CR52, 53 | 755-818496 | Diode, Zener, 5.1V | Motorola 1N751A | 2 |
| Q56 | 755-817964 | Transistor, Type 2N1420 | P.S.I. 2N1420 | 1 |
| Q55 | 755-814332 | Transistor, Silicon, 2N1027 | Sperry Sim 2N1027 | 1 |
| R63 | 601-015039 | Resistor, F.Comp., 1.2K, 1/2W, 5% | Allen Bradley EB1225 | 1 |
| R64 | 601-015460 | Resistor, F.Comp., 3.3K, 1/2W, 5% | Allen Bradley EB3325 | 1 |
| R65, 66 | 601-015038 | Resistor, F.Comp., 1K, 1/2W, 5% | Allen Bradley EB1025 | 2 |

## TEMPERATURE CONTROL BOARD*

| | | | | |
|---|---|---|---|---|
| | | Temperature Control Board | Beckman | 1 |
| C51, 52, 54 | 631-802980 | Capacitor, F.Elect., 22μf, 25V, ±20% | Sprague 109D226X0025C2 | 3 |
| C53 | 637-808468 | Capacitor, F.Mica, 3300pf, 500V, 10% | Elmenco DM-20-332 | 1 |
| CR51 | 755-402107 | Diode, Germanium, Special | Beckman | 1 |
| Q51, 52 | 755-817964 | Transistor, Type 2N1420 | P.S.I. 2N1420 | 2 |
| R51 | 601-079172 | Resistor, F.Comp., 820Ω, 1/2W, 5% | Allen Bradley EB8215 | 1 |
| R52, 54 | 601-022930 | Resistor, F.Comp., 100Ω, 1/2W, 5% | Allen Bradley EB1015 | 2 |
| R53 | 601-015447 | Resistor, F.Comp., 680Ω, 1/2W, 5% | Allen Bradley EB6815 | 1 |
| R55 | 601-800011 | Resistor, F.Comp., 270Ω, 1/2W, 5% | Allen Bradley EB2715 | 1 |
| R56 | 601-008129 | Resistor, F.Comp., 1.5K, 1/2W, 5% | Allen Bradley EB1525 | 1 |
| R57 | 601-000897 | Resistor, F.Comp., 2.2K, 1/2W, 5% | Allen Bradley EB2225 | 1 |
| R58 | 601-800001 | Resistor, F.Comp., 2.7Ω, 1/2W, 5% | Allen Bradley EB27G5 | 1 |
| R60 | 611-806222 | Resistor, V. WW, 2K, 1/4W, 10% | Bourns 200P-1-203 | 1 |
| R61 | xxx-xxxxxx | Resistor (Factory selected value) | | |
| R62 | 607-829688 | Resistor, F.Film, 240Ω, 1/2W, 5% | Stemag SLAD | 1 |
| SCR51 | 774-837861 | Silicon Control Rectifier | G.E., 2N2327 | 1 |

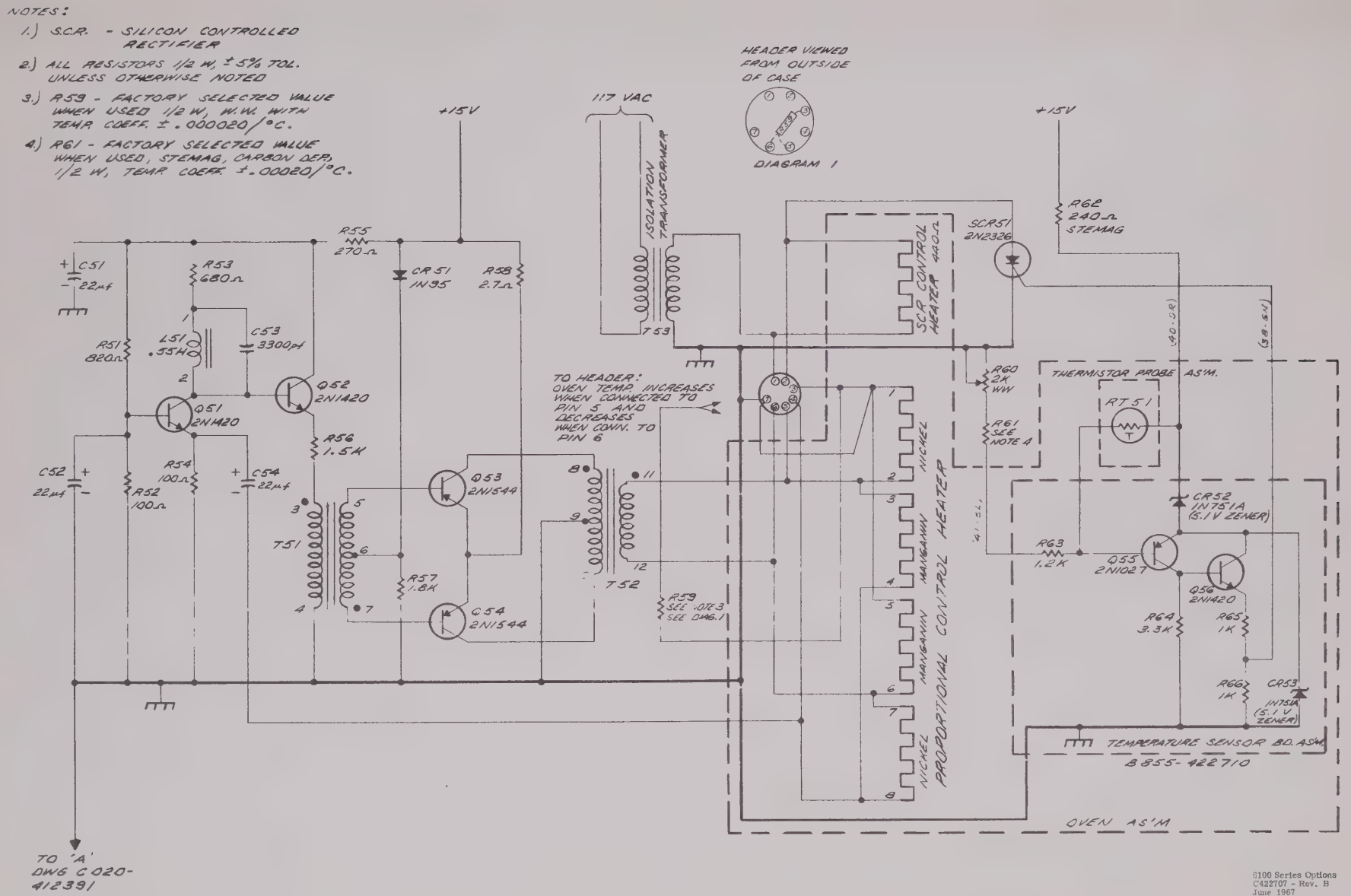
*Part of 1 MHz Precision Oscillator Assembly (Part number 855-423561)

## MISCELLANEOUS PARTS

(Temperature Sensor and Temperature Control Boards)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| L51 | 792-422735 | Transformer, Special | Beckman | 1 |
| Q53, 54 | 755-822107 | Transistor, Power, 90W | Motorola 2N1544 | 2 |
| R59 | 601-xxxxxx | Resistor (Factory selected value when used) | Beckman | 1 |
| RT51 | 626-424900 | Thermistor, 20K, 20% ea. 25°C | Beckman | 1 |
| T51, 52 | | Transformer, part of L51 | Beckman | 1 |
| T53 | 792-422825 | Transformer, Special, Isolation | Beckman | 1 |
| | 695-815672 | Terminal, Feed-thru | Fuseite 105 HTL 45° | 10 |
| | 678-817326 | Header, 7-Pin | Fuseite 53-730-40-P1/ FP-7A | 1 |

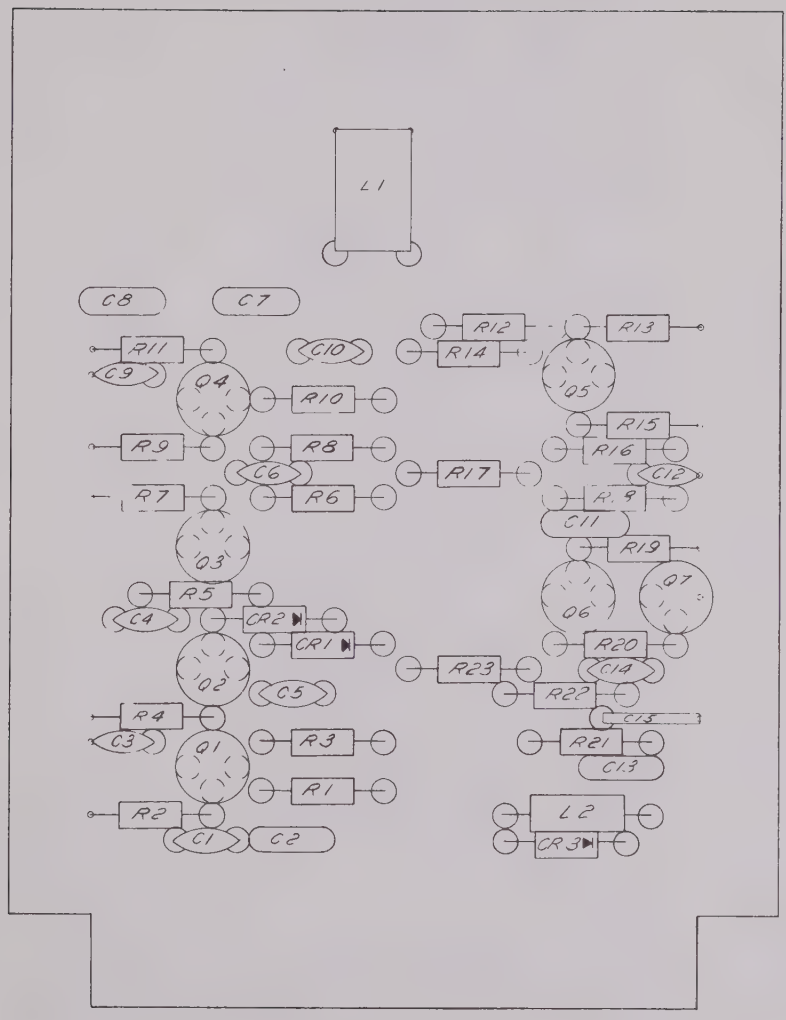
OPTION AB
TEMPERATURE CONTROL, SCR MODE
SCHEMATIC DIAGRAM






0100 Series Options
C422707 - Rev. B
June 1967

Beckman®

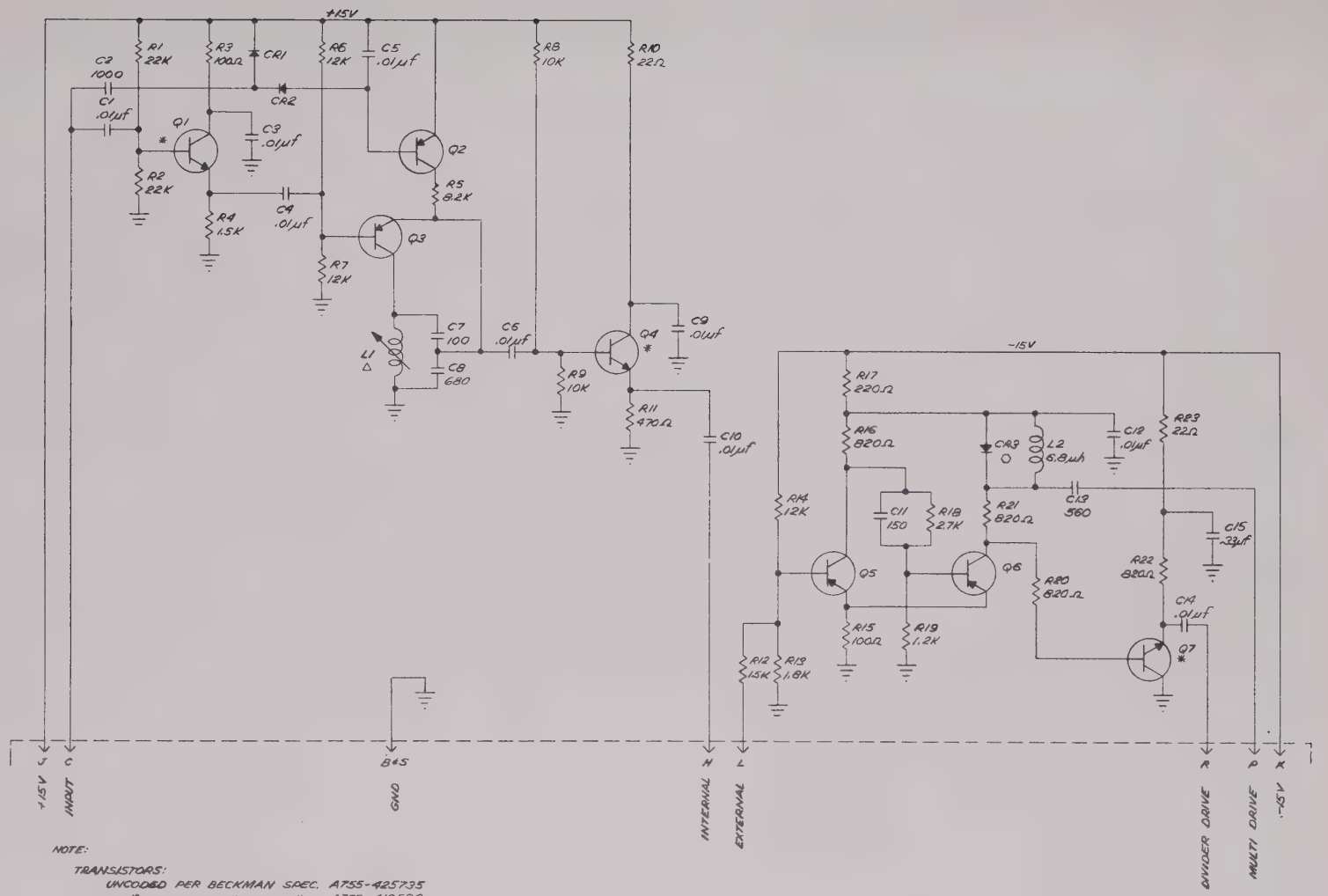



OPTION ACM
1 MHz SHAPER AND DIVIDER COMPONENT LAYOUT

## 1 MHz SHAPER & DIVIDER BOARD

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C1, 3, 4, 5, 6, 9, 10, 12, 14 | 633-836864 | Capacitor, F.Cerm., 0.01μf, 50V | Sprague 19C214A6 | 9 |
| C2 | 637-822757 | Capacitor, F.Mica, 1000pf, 100V, 5% | Electromotive DM15F102J0-100WV4CR | 1 |
| C7 | 637-822251 | Capacitor, F.Mica, 100pf, 500V, 5% | Electromotive DM15F101J0-500WV4CR | 1 |
| C8 | 637-825496 | Capacitor, F.Mica, 680pf, 300V, 5% | Electromotive DM15F681J0-300WV4CR | 1 |
| C11 | 637-825104 | Capacitor, F.Mica, 150pf, 500V, 5% | Electromotive DM15F151J0-500WV4CR | 1 |
| C13 | 637-819381 | Capacitor, F.Mica, 560pf, 300V, 5% | Electromotive DM15F561J0-300WV1CR | 1 |
| C15 | 633-815873 | Capacitor, F.Cerm., 0.33μf, 25V | Sprague 5C10A | 1 |
| CR1, 2 | 755-431324 | Diode, Special, Silicon | Beckman | 2 |
| CR3 | 755-402107 | Diode, Special | Beckman | 1 |
| L1 | 795-434743 | Inductor, Variable | Beckman | 1 |
| L2 | 795-827337 | Inductor, Fixed, 6.8μH, 10% | National NB -6.81 | 1 |
| Q1, 4, 7 | 755-419596 | Transistor, Special | Beckman | 3 |
| Q2, 3, 5, 6 | 755-425735 | Transistor, Special | Beckman | 4 |
| R1, 2 | 601-822334 | Resistor, F.Comp., 22K, 1/4W, 5% | Allen Bradley CB2235 | 2 |
| R3, 15 | 601-817735 | Resistor, F.Comp., 100Ω, 1/4W, 5% | Allen Bradley CB1015 | 2 |
| R4, 12 | 601-822527 | Resistor, F.Comp., 1.5K, 1/4W, 5% | Allen Bradley CB1525 | 2 |
| R5 | 601-822331 | Resistor, F.Comp., 8.2K, 1/4W, 5% | Allen Bradley CB8225 | 1 |
| R6, 7, 14 | 601-801803 | Resistor, F.Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 3 |
| R8, 9 | 601-822324 | Resistor, F.Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 2 |
| R10, 23 | 601-823383 | Resistor, F.Comp., 22Ω, 1/4W, 5% | Allen Bradley CB2205 | 2 |
| R11 | 601-823395 | Resistor, F.Comp., 470Ω, 1/4W, 5% | Allen Bradley CB4715 | 1 |
| R13 | 601-822544 | Resistor, F.Comp., 1.8K, 1/4W, 5% | Allen Bradley CB1825 | 1 |
| R16, 20, 21, 22 | 601-822306 | Resistor, F.Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 4 |
| R17 | 601-822327 | Resistor, F.Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 1 |
| R18 | 601-822295 | Resistor, F.Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 1 |
| R19 | 601-822326 | Resistor, F.Comp., 1.2K, 1/4W, 5% | Allen Bradley CB1225 | 1 |

OPTION ACM
1 MHz SHAPER AND DIVIDER
SCHEMATIC DIAGRAM




NOTE:

TRANSISTORS:
UNCODED PER BECKMAN SPEC. A755-425735
* " " " A755-419596

COIL:
△ IS BECKMAN SPEC. B795-934743

DIODES:
UNCODED ARE BECKMAN SPEC. A755-431329
○ " " " A755-902107

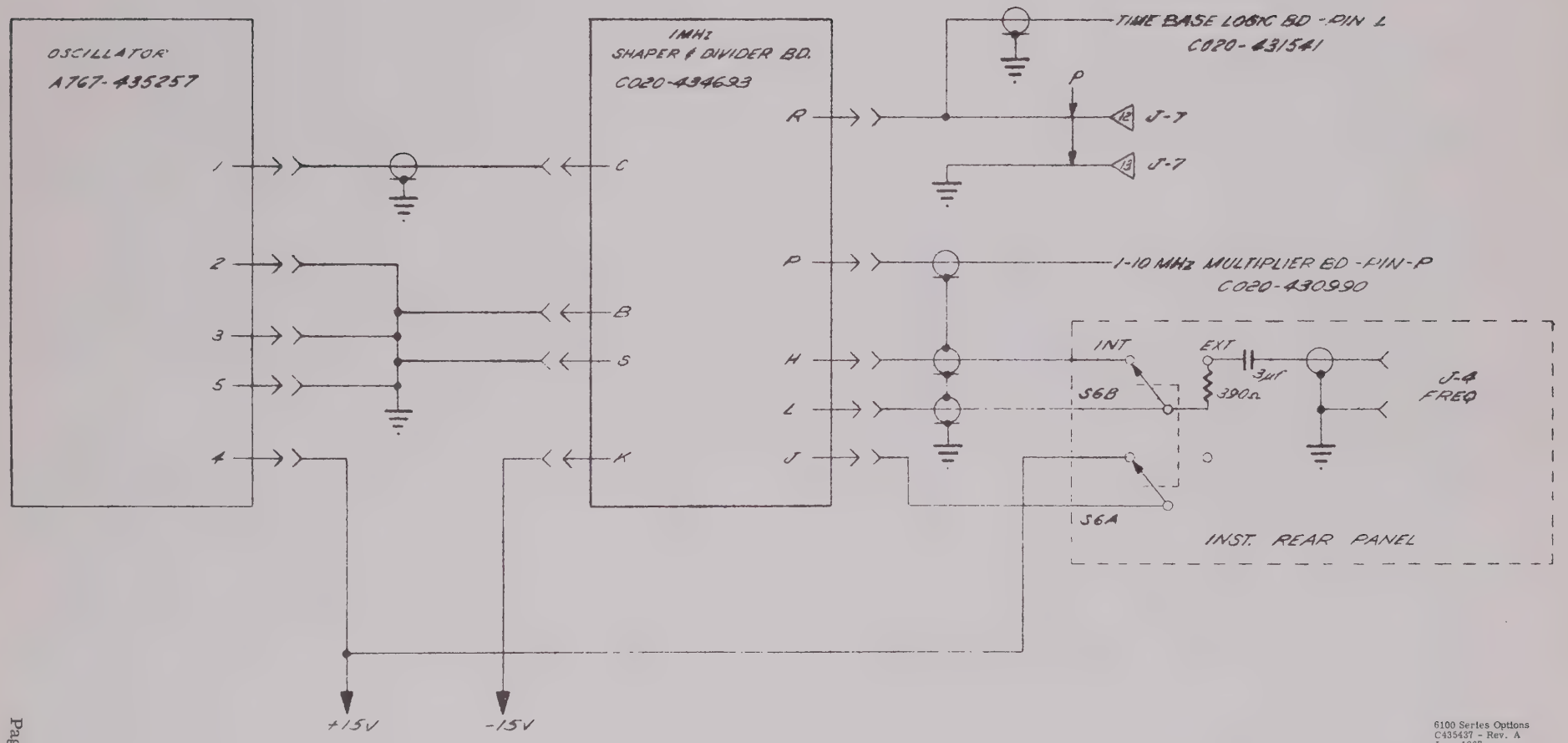
RESISTORS: 1/4W, 5% UNLESS NOTED

CAPACITORS: VALUES IN pf UNLESS NOTED



Beckman

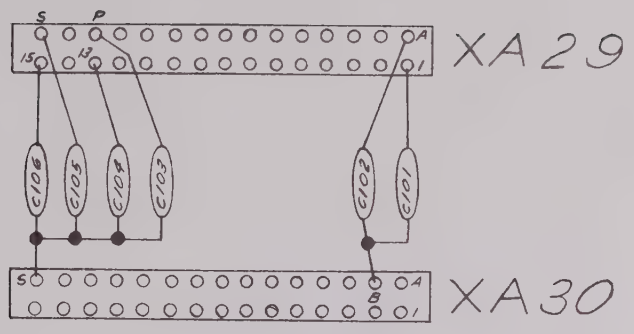
OPTION ACM
1 MHz TIMING MODULE
SCHEMATIC DIAGRAM






6100 Series Options
C435437 - Rev. A
June 1967

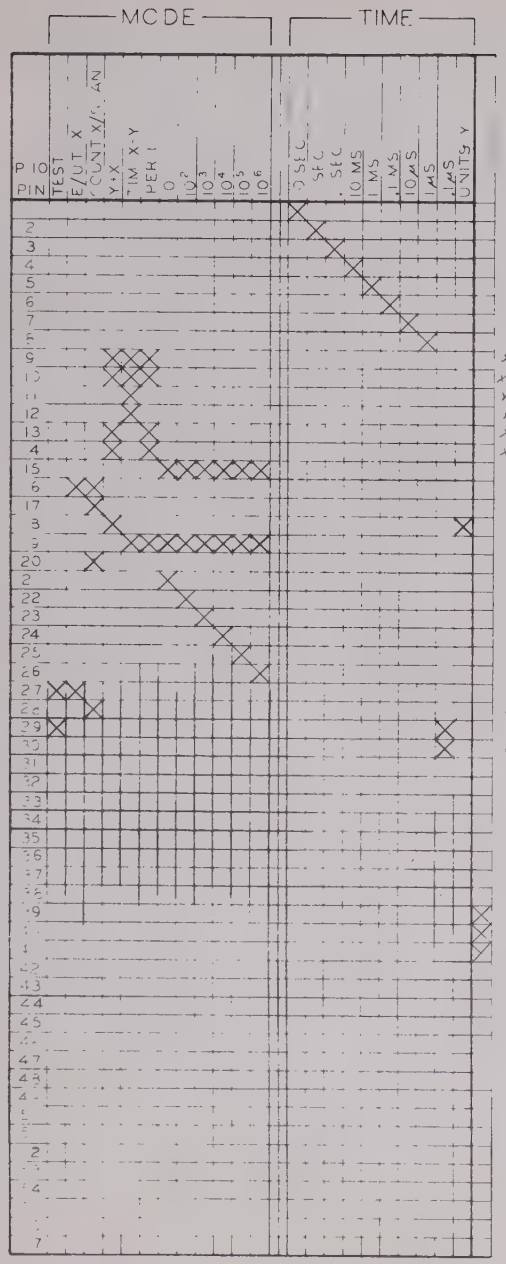
Beckman




## OPTION AD
## REMOTE PROGRAM COMPONENT LAYOUT

### REMOTE PROGRAM COMPONENT ASSEMBLY

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C101 thru C106 | 633-804717 | Capacitor, F.Cerm., 0.01μf, 500V | Sprague 29C9B5 | 6 |
| J10 | 672-806840 | Connector, Receptacle, 57 Contacts, female | Cannon DPX-57-34S | 1 |
| P10 | 672-806839 | Connector, Plug, 57 Contacts, male | Cannon DPX-S7-34P | 1 |
| R101 | 601-822308 | Resistor, F.Comp., 1K, 1/4W, 5% | Allen Bradley CB1025 | 1 |

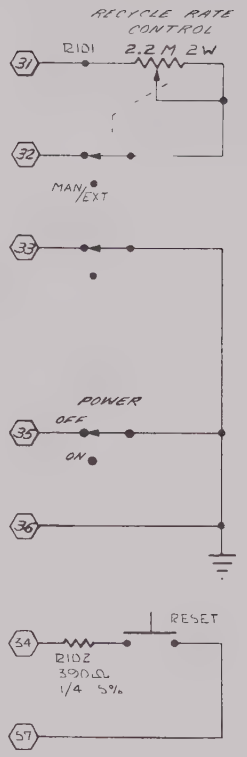



X START+ } SELECT 1
X START− "
Y STOP+ "
Y STOP− "
X STOP+ "
X STOP− "

START COUNT 601/602 ONLY

C. µS RATE TIME 601 602 A.C.

FORM C ARM
N.O. CONTACT (+ POLARITY) } SEE NOTE #5
N.C. CONTACT (− POLARITY)



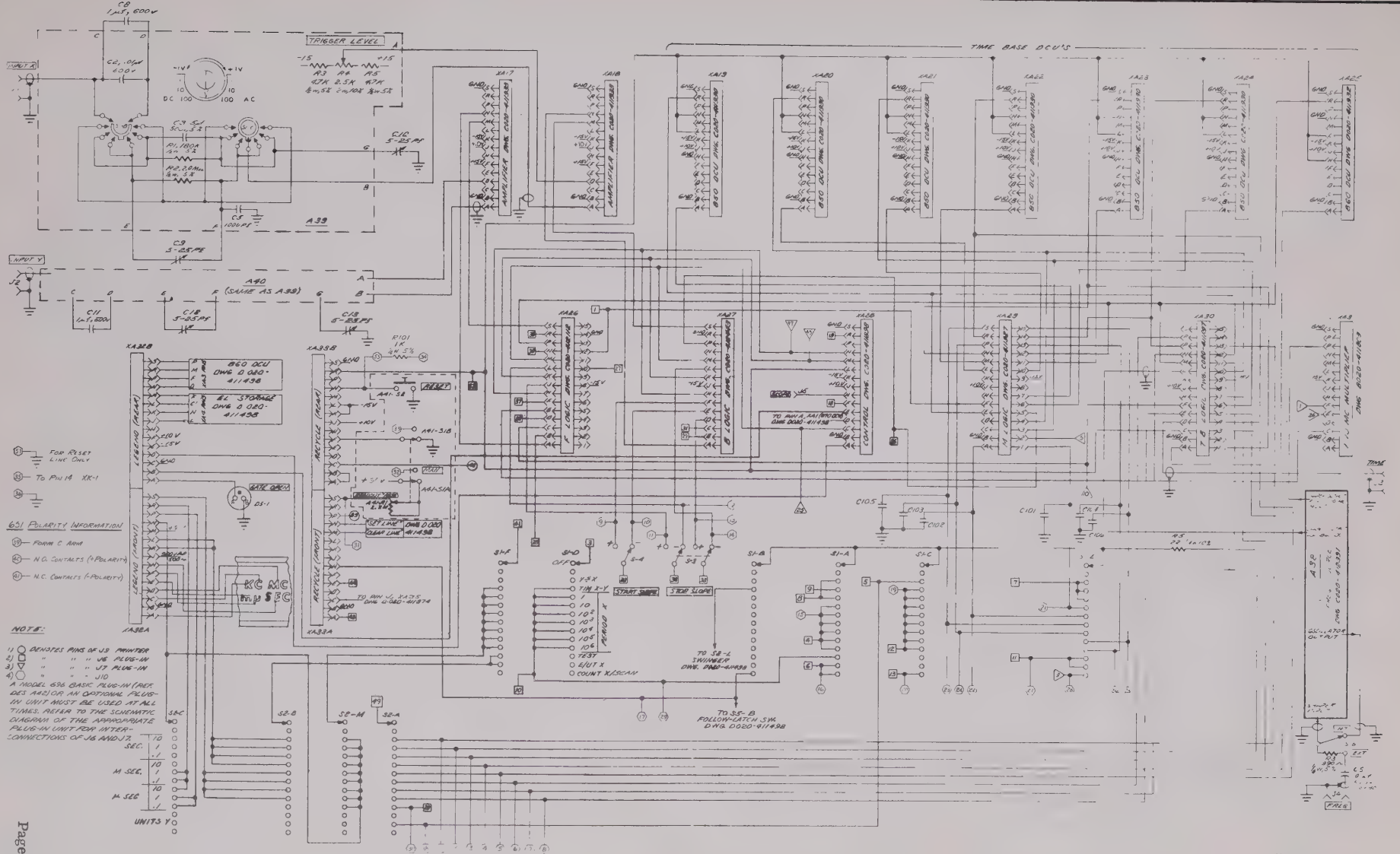

NOTE:

1. USE 1 µS ONLY IN TIM X·Y PER X.
2. SEE INSTRUCTION MANUAL TABLE 2-2 FOR INCOMPATABLE MATRIX COMBINATION.
3. ☒ TIE THIS PIN TO SIGNAL GND (PIN 36)
   EXAMPLE:
   IF E/UT X, 1 µS TIME BASE ARE SELECTED, GROUND PINS 5, 16 & 27.
4. IF A TRANSISTOR SWITCH IS USED FOR #3 ABOVE, IT MUST BE OPERATED IN THE SATURATED CONDITION, TURNED ON (PNP)
5. THIS POLARITY INFORMATION IS AVAILABLE ONLY WHEN 651 PLUG-IN IS EMPLOYED.

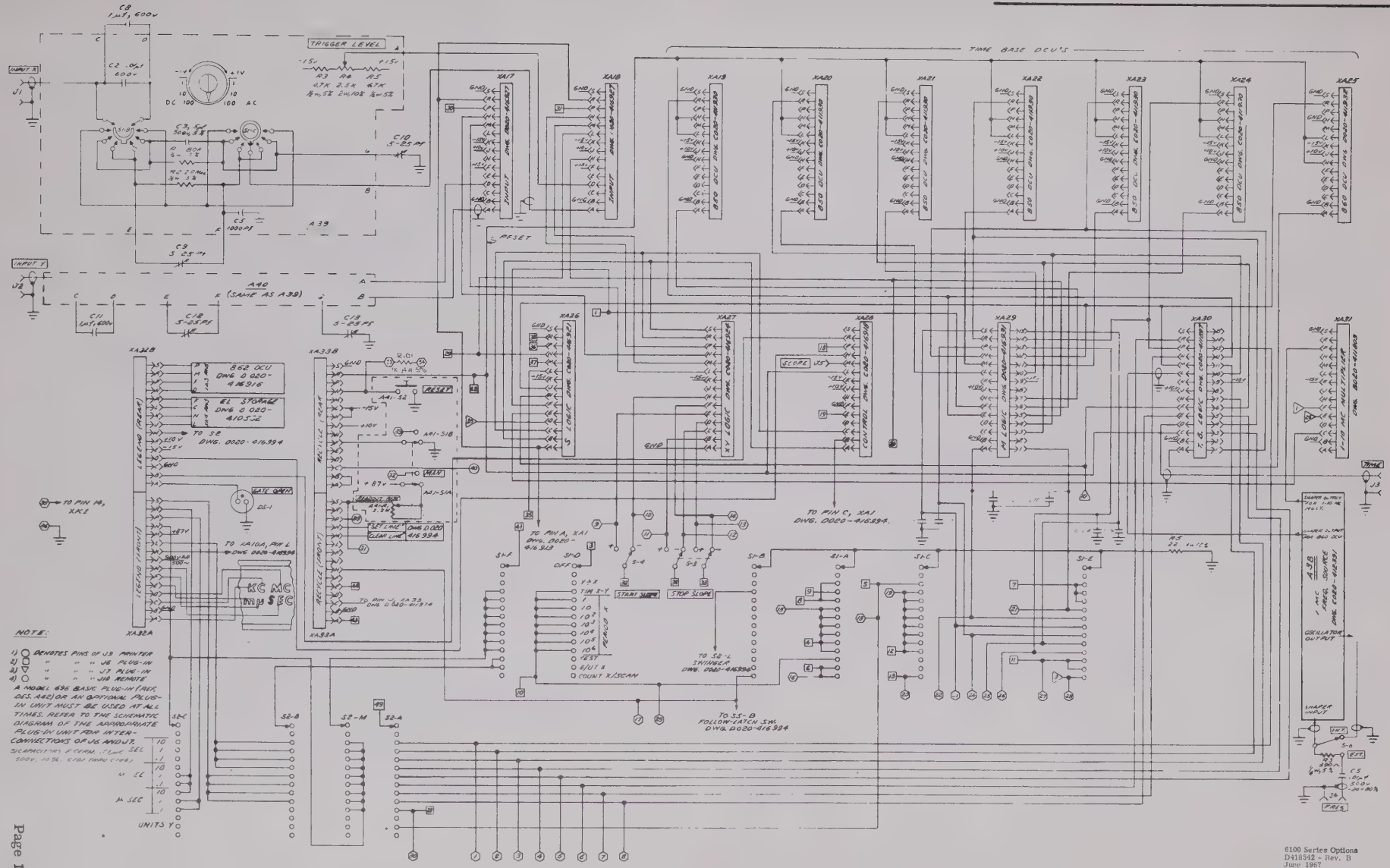


6100 Series Options
C418543 - Rev. C
June 1967
Beckman

OPTION AD
REMOTE UNIT LOGIC
SCHEMATIC DIAGRAM (Models 6126/44/46)



OPTION AD
REMOTE UNIT LOGIC
SCHEMATIC DIAGRAM (Models 6127/6147)

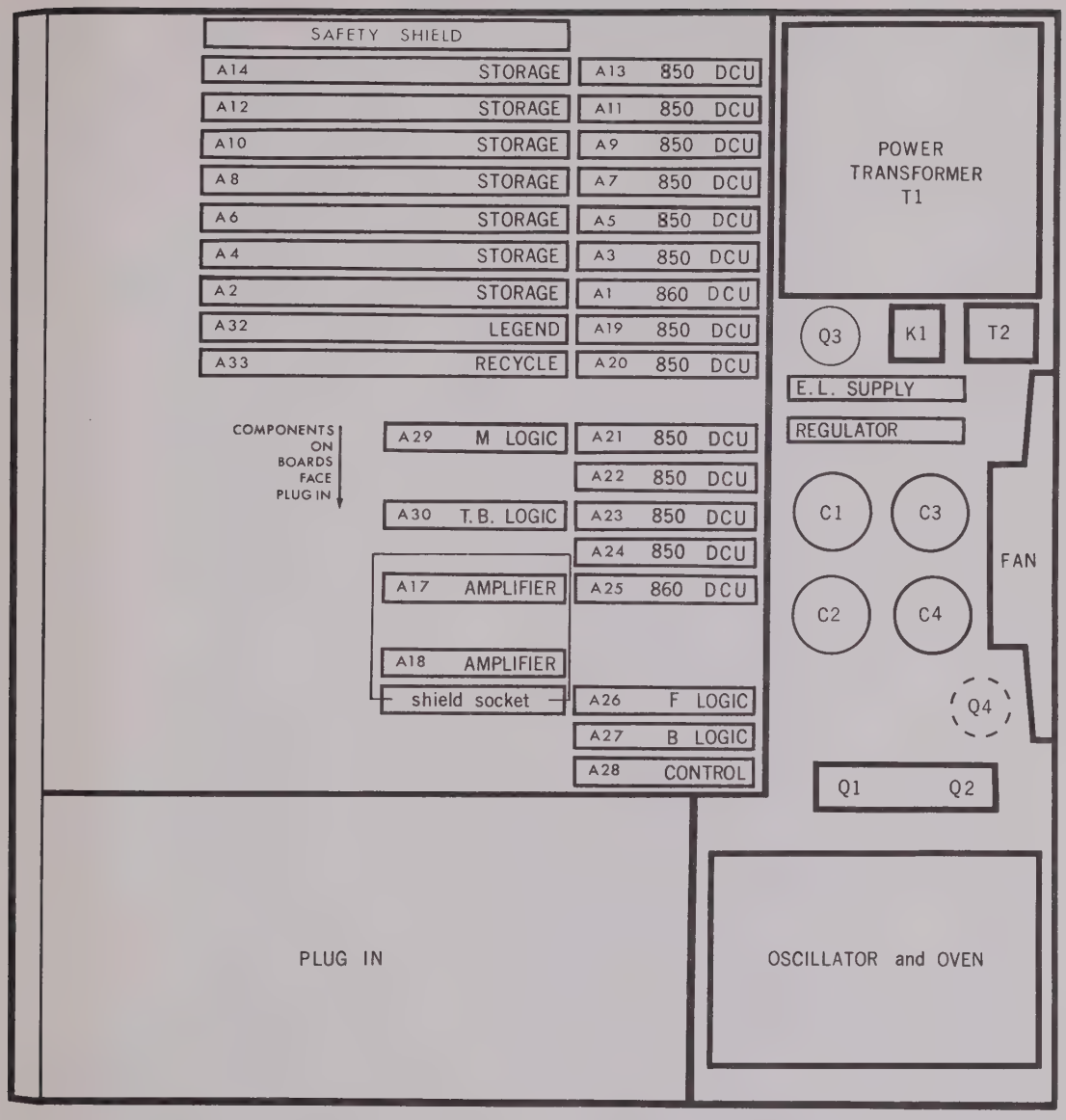

TIME BASE DCU'S
TRIGGER LEVEL
RESET
INPUT X
INPUT Y
A39
A40 (SAME AS A39)
TO PIN C, XA1 DWG. 0020-416894.
TO PIN A, XA1 DWG. 0020-416893
TO PIN W, XA32 DWG. 0020-416914
TO XA10A, PIN L DWG 0020-416894
TO PIN H4, XK2
TO S2-L SWINGER DWG. 0020-416894
TO S5-B FOLLOW-LATCH SW. DWG. 0020-416894
START SWEEP
STOP SWEEP
SCOPE
GATE GEN
KC MC
m μ SEC
UNITS Y
NOTE:
1) DENOTES PINS OF J3 PRINTER
2) " " " J6 PLUG-IN
3) " " " J7 PLUG-IN
4) " " " J10 REMOTE
A MODEL 696 BASIC PLUG-IN (REF. DES. A43) OR AN OPTIONAL PLUG-IN UNIT MUST BE USED AT ALL TIMES. REFER TO THE SCHEMATIC DIAGRAM OF THE APPROPRIATE PLUG-IN UNIT FOR INTER-CONNECTIONS OF J6 AND J7.





Beckman

# Section 5




Beckman EPUT and TIMER MODEL 6144

**CAUTION**

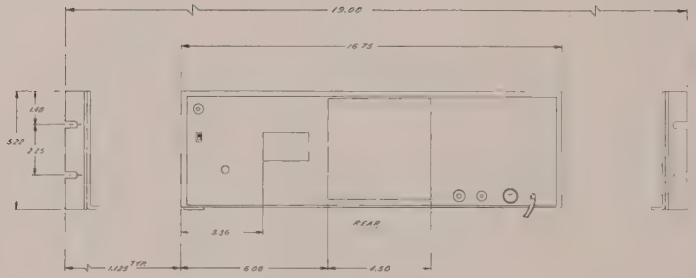
HIGH VOLTAGE: 900 v pp AND 90vDC ON POWER SUPPLY AND READOUT CIRCUITRY.
OSCILLATOR IS ON WHEN POWER CORD IS CONNECTED.
DISCONNECT POWER CORD BEFORE REMOVING REGULATOR BOARD.

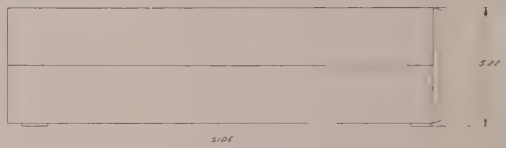
## MODEL 6144 COMPONENT BOARD LAYOUT

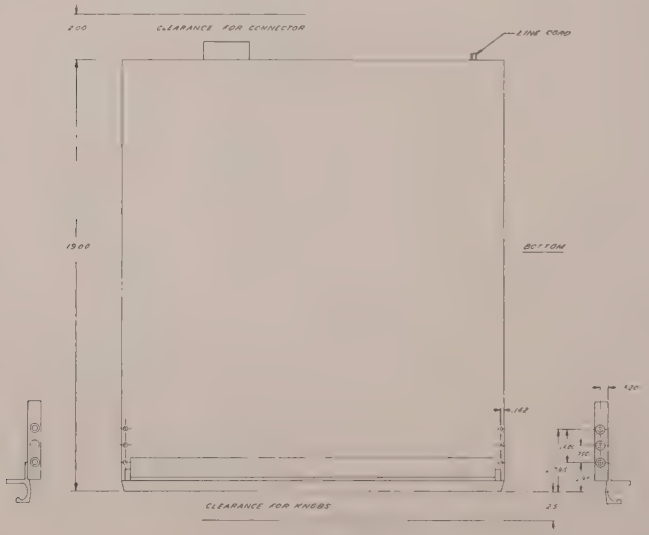
## MISCELLANEOUS PARTS
(Model 6144 Outline Drawing)

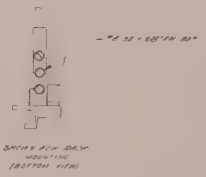
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| | 241-824552 | Fan Blade, 4-inch nylon | Howard, Inc. 218-152 | 1 |
| | 317-413693 | Hinge, Handle | Beckman | 2 |
| | 327-411656 | Printed Circuit Board Holder | Beckman | 8 |
| | 842-819209 | Fan Motor | Howard, Inc. 1075-3202 | 1 |
| | 776-411321 | Heat Sink | Beckman | 1 |
| | 776-827328 | Heat Sink | Augut 9015-1G1 | 1 |
| | 864-806361 | Insulator, Transistor Mtg., Aluminum | Monadnock 294457 | 2 |
| | 330-413694 | Handle, Cast | Beckman | 1 |
| | 337-413108 | Fan Guard | Beckman | 1 |
| | 433-413055 | Rear Panel | Beckman | 1 |
| | 327-415619 | P.C. Board Holder, Asm., Modification | Beckman | 1 |
| | 327-414710 | Modified P.C. Board Holder | Beckman | 1 |
| | 349-414969 | Tilt Foot | Beckman | 1 |
| | 338-414685 | Spring Clamp, Tilt Foot | Beckman | 2 |
| | 348-414684 | Detent Plate, Tilt Foot | Beckman | 2 |
| | 349-414683 | Locking Plate, Tilt Foot | Beckman | 2 |
| | 302-413690 | Spring Detent, Tilt Foot | Beckman | 2 |
| | 125-415249 | Hinge Pin, Tilt Foot | Beckman | 2 |
| | 302-413692 | Spring, Handle | Beckman | 2 |
| | 327-413153 | Bracket, Plug-In Conn. | Beckman | 1 |
| | 405-413714 | Pin Guide | Beckman | 1 |
| | 662-414822 | Cable, Digital Recorder | Beckman | 1 |
| | 662-414804 | Cable J7 Plug-In | Beckman | 1 |
| | 010-414488 | Heat Sink Assembly | Beckman | 1 |
| | 132-824977 | Clip, Retainer, Indicator Lamp | Eldema 10905-01 | 1 |
| | 664-812450 | Cordset, Elect., Power, 3 Cond., Blk, 6 ft. | Beckman | 1 |
| | 325-413171 | Knob, Round, Skirted | Beckman | 2 |
| | 325-413174 | Knob, Round, Skirted, Concentric Base | Beckman | 2 |
| | 325-415351 | Knob, Power | Beckman | 1 |
| | 325-415350 | Knob, Attenuator | Beckman | 2 |
| | 325-415335 | Knob, Display | Beckman | 1 |
| | 433-411659 | Front Panel | Beckman | 1 |
| | 783-807862 | Ferrite Bead | Ferroxcube 56-590-65/3B | 2 |
| | 349-413691 | Retainer, Top Cover | Beckman | 1 |
| | 405-415007 | Right Guide, Top Cover | Beckman | 1 |
| | 405-415006 | Left Guide, Top Cover | Beckman | 1 |
| | 297-413615 | Top Cover | Beckman | 1 |
| | 778-416305 | Shield, Attenuator | Beckman | 1 |
| | 716-413516 | Reset Button | Beckman | 1 |
| | 778-412944 | E.L. Shield | Beckman | 1 |
| | 297-413696 | Bottom Dust Cover | Beckman | 1 |
| | 887-422136 | Safety Shield | Beckman | 1 |
| | 327-409643 | P.C. Board Support | Beckman | 2 |
| | 430-415711 | Chassis Oscillator | Beckman | 1 |
| | 327-404468 | Printed Circuit Board Support | Beckman | 4 |
| | 855-415073 | Power Supply Assembly | Beckman | 1 |
| | 855-415114 | Time Switch Assembly | Beckman | 1 |

## MODEL 6144
## OUTLINE DRAWING



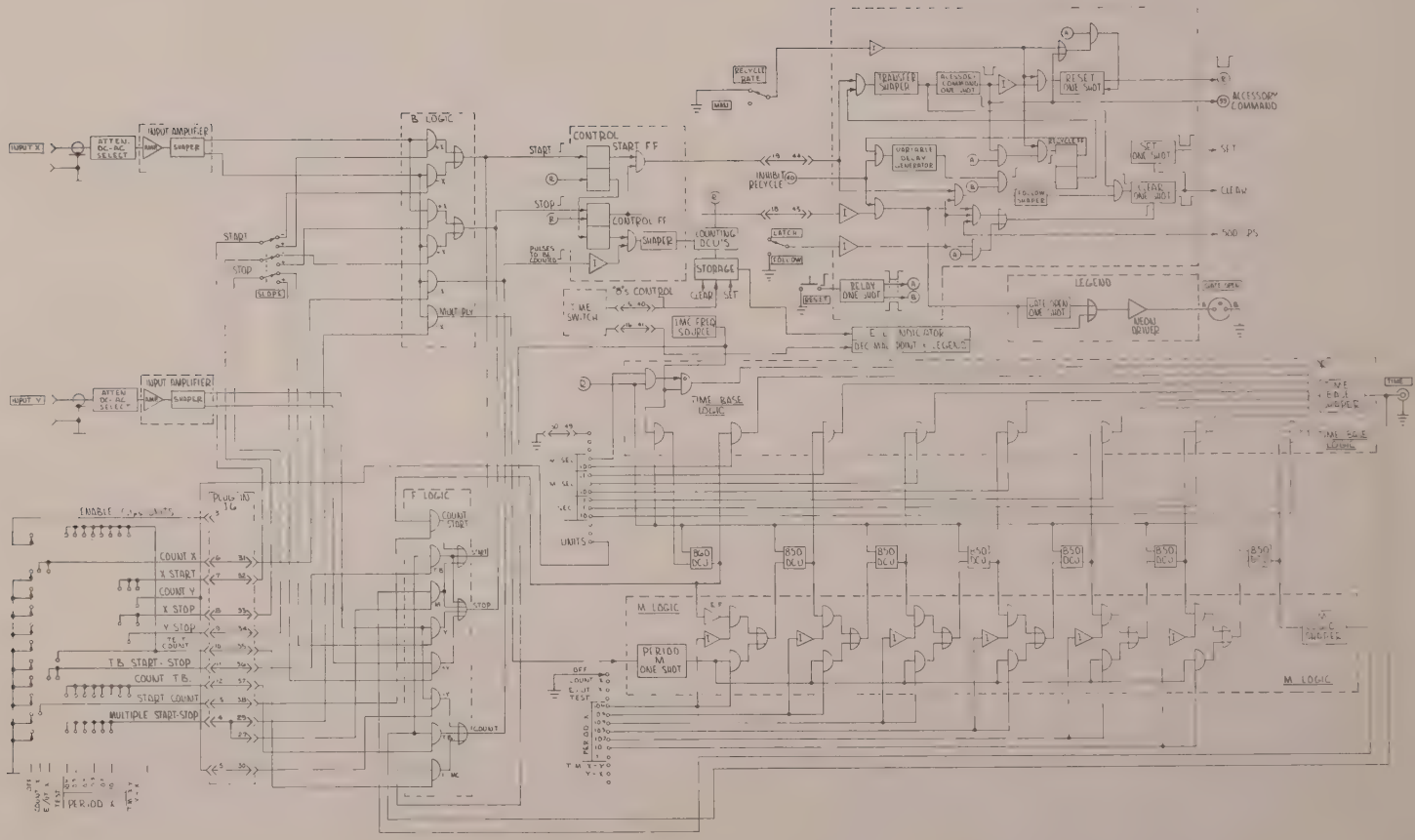




Model 6144
TM15600 - Rev B
March 1967

Beckman




Model 6144
IM-6144 - Rev. D
May-B 1967

Beckman

## MODEL 6144

### J6 PIN ASSIGNMENTS

| Pin No. | Connection* |
|---|---|
| 1 | XA26-K |
| 2 | -- |
| 3 | S1D-1 |
| 4 | S1A-6 |
| 5 | S2A-13 |
| 6 | S1A-13 |
| 7 | S1E-3 |
| 8 | S1A-3 |
| 9 | S1A-4 |
| 10 | S1A-12 |
| 11 | S1E-12 |
| 12 | S1C-4 |
| 13 | S1C-14 |
| 14 | -- |
| 15 | S2K-11 |
| 16 | S1H-3 |
| 17 | -- |
| 18 | XA28-P |
| 19 | XA28-E |
| 20 | XA1-P |
| 21 | XA1-M |
| 22 | XA1-F |
| 23 | XA1-D |
| 24 | -- |
| 25 | XA5-E |
| 26 | XA18-H |
| 27 | XA26-8 |
| 28 | S2A-11 |
| 29 | XA18-L |
| 30 | XA17-P |
| 31 | XA18-P |
| 32 | S4 |
| 33 | S3 |
| 34 | S3 |
| 35 | XA26-3 |
| 36 | XA26-12 |
| 37 | XA26-4 |
| 38 | XA26-N |
| 39 | -- |
| 40 | XA2B-J |
| 41 | S1F-1 |
| 42 | XA28-L |
| 43 | XA33A-A |
| 44 | XA33A-E |
| 45 | XA32B-J |
| 46 | XA32B-K |
| 47 | XA32B-L |
| 48 | XA32B-M |
| 49 | S2A-1 |
| 50 | XA26-15 |

*Amphenol 57-20500
50 Contact Connections
(672-824946)

### J7 PIN ASSIGNMENTS

| Pin No. | Connection* |
|---|---|
| 1 | -- |
| 2 | -- |
| 3 | S1-E Count |
| 4 | -- |
| 5 | XA29-2 |
| 6 | -- |
| 7 | -- |
| 8 | -- |
| 9 | -- |
| 10 | XA26-C |
| 11 | -- |
| 12 | 1 MHz High |
| 13 | 1 MHz Low |
| 14 | -- |
| 15 | +90V |
| 16 | -- |
| 17 | -- |
| 18 | -- |
| 19 | 117V ac |
| 20 | -- |
| 21 | -- |
| 22 | -- |
| 23 | -- |
| 24 | -- |
| 25 | XA28-C |
| 26 | -- |
| 27 | -- |
| 28 | -- |
| 29 | -- |
| 30 | -- |
| 31 | -- |
| 32 | -- |
| 33 | -- |
| 34 | -- |
| 35 | -- |
| 36 | -- |
| 37 | -- |
| 38 | -- |
| 39 | -- |
| 40 | +10V |
| 41 | -15V |
| 42 | +15V |
| 43 | -- |
| 44 | 117V ac |
| 45 | XA28-M |
| 46 | XA28-N |
| 47 | -- |
| 48 | Ground |
| 49 | -- |
| 50 | Ground |

*Amphenol 57-20500
50 Contact Connections
(672-824946)

### J9 PIN ASSIGNMENTS

| Pin No. | Connection* |
|---|---|
| 1 | XA12B-S |
| 2 | XA12B-P |
| 3 | XA12B-D |
| 4 | XA12B-A |
| 5 | XA10B-S |
| 6 | XA10B-P |
| 7 | XA10B-D |
| 8 | XA10B-A |
| 9 | XA8B-S |
| 10 | XA8B-P |
| 11 | XA8B-D |
| 12 | XA8B-A |
| 13 | XA6B-S |
| 14 | XA6B-P |
| 15 | XA6B-D |
| 16 | XA6B-A |
| 17 | XA4B-S |
| 18 | XA4B-P |
| 19 | XA4B-D |
| 20 | XA4B-A |
| 21 | XA2B-S |
| 22 | XA2B-P |
| 23 | XA2B-D |
| 24 | XA2B-A |
| 25 | XA14B-S |
| 26 | XA14B-P |
| 27 | XA14B-D |
| 28 | XA14B-A |
| 29 | -- |
| 30 | -- |
| 31 | -- |
| 32 | Ground |
| 33 | XA16B-S |
| 34 | XA16B-P |
| 35 | Ground |
| 36 | XA16B-D |
| 37 | XA16B-A |
| 38 | XA2B-B (Gnd) |
| 39 | XA33A-P |
| 40 | XA33B-C |

*Cannon DPX-40-34S
40 Contact Connections
(672-806833)

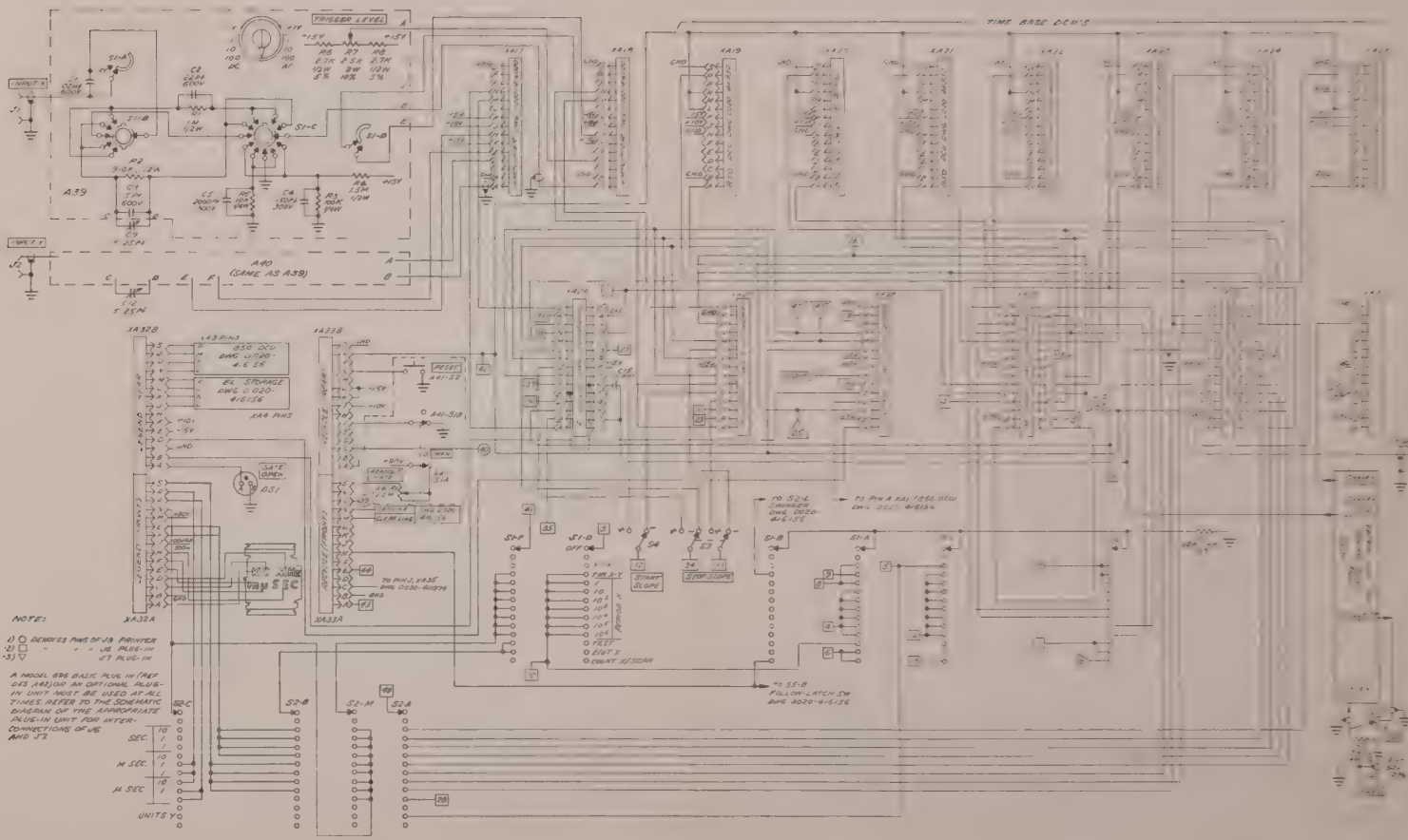
## ATTENUATOR SWITCH ASSEMBLY (A39 & A40)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A39, 40 | 855-416144 | Attenuator Switch Assembly | Beckman | 2 |
| C1 | 633-804722 | Capacitor, F. Cerm., 0.02μf, 600V | Erie 817-.02 | 2 |
| C2 | 633-804667 | Capacitor, F. Cerm., 22pf, 600V | Centralab TCZ-22 | 2 |
| C3 | 633-804657 | Capacitor, F. Cerm., 5pf, 600V | Erie NPOK-050D | 2 |
| C4 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Arco DM-16E151J-300 | 2 |
| C5 | 637-824301 | Capacitor, F. Mica, 2000pf, 300V, 5% | Arco DM-20F202J-300 | 2 |
| R1 | 601-041151 | Resistor, F. Comp., 1M, 1/2W, 5% | Allen Bradley EB1055 | 2 |
| R2 | 601-008147 | Resistor, F. Comp., 910K, 1/2W, 5% | Allen Bradley EB9145 | 2 |
| R3 | 601-823904 | Resistor, F. Comp., 100K, 1/4W, 5% | Allen Bradley CB1045 | 2 |
| R4 | 601-013193 | Resistor, F. Comp., 1.5M, 1/2W, 5% | Allen Bradley EB1555 | 2 |
| R5 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 2 |
| R6, R8 | 601-015045 | Resistor, F. Comp., 2.7K, 1/2W, 5% | Allen Bradley EB2725 | 4 |
| R7 | 614-414678 | Resistor, V. Comp., 2.5K, ±10% | Beckman | 2 |
| S1 | 711-415565 | Attenuator Switch | Beckman | 2 |

## MISCELLANEOUS PARTS
(Model 6144 Unit Logic)

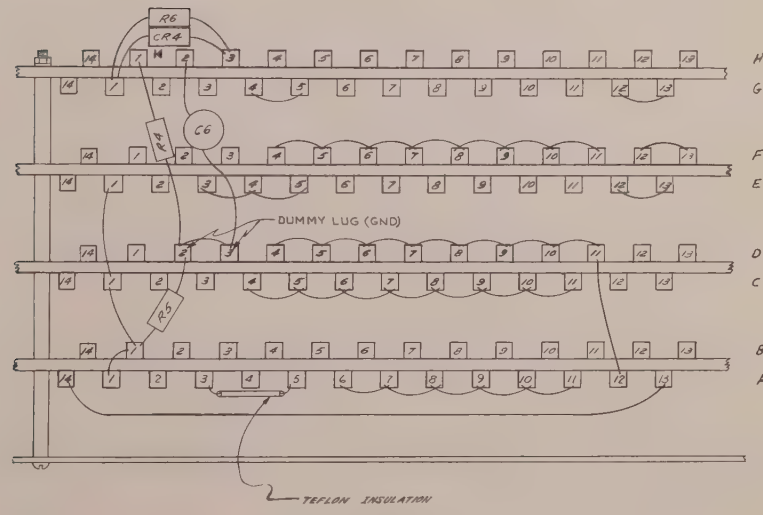
| | | | | |
|---|---|---|---|---|
| A41 | 711-413778 | Reset, Recycle Rate Assembly | Beckman | 1 |
| A41-R1 | 601-824831 | Resistor, F. Comp., 2.2M, 1/4W, 10% | Allen Bradley CB2251 | 1 |
| C5 | 639-835127 | Capacitor, F. Cerm., 3μf, 50V, 10% | Elpac VX5A305 | 1 |
| C9, 12 | 643-805005 | Capacitor, V. Cerm., 5-25pf, 350V | Erie 557-F | 2 |
| C15 | 637-824016 | Capacitor, F. Mica, 100pf, 300V, 5% | Electromotive DM16E101J-300 | 1 |
| DS1 | 824-824973 | Lamp, Neon, Plug-In Cartridge | Eldema CG3-CC-A1B | 1 |
| J1, 2, 3, 4 | 670-806738 | Connector, Coaxial, Receptacle, BNC Type | Amphenol UG-1094/U | 4 |
| J5 | 683-817991 | Jack, Banana, Red Nylon | Johnson 108-902 | 1 |
| J6, 7 | 672-824946 | Connector, Receptacle, 50 Female Contacts | Amphenol 57-20500 | 2 |
| J9 | 672-806833 | Connector, Receptacle, 40 Female Contacts | Cannon DPX-40-34S | 1 |
| R3 | 601-822371 | Resistor, F. Comp., 390Ω, 1/4W, 5% | Allen Bradley CB3915 | 1 |
| R10 | 601-812856 | Resistor, F. Comp., 2.2K, 1/4W, 10% | Allen Bradley CB2221 | 1 |
| S1 | 711-412989 | Switch Spec. 14 Pos. 4 Sec. Type 7141R | Beckman P/O 50-414795 | 1 |
| S2 | 711-413605 | Switch Spec. 14 Pos. 7 Sec. | Beckman P/O 50-415114 | 1 |
| S3 | 701-806040 | Switch, Toggle, DPDT, 3A at 250V ac | Cutler Ham. 8373K8 | 1 |
| S4 | 701-806039 | Switch, Toggle, SPDT, 1A at 250V ac | Cutler Ham. 8282K13 | 1 |
| S5 | 711-413785 | Switch, Rotary, Oak Type F | Beckman | 1 |
| S6 | 716-827410 | Switch, Slide, DPDT | Continental Type 126 (C-W) | 1 |
| XDS1 | 824-824974 | Socket, Lamp Cartridge Mounting | Eldema #2K | 1 |

ATTENUATOR SWITCH ASSEMBLY, A39



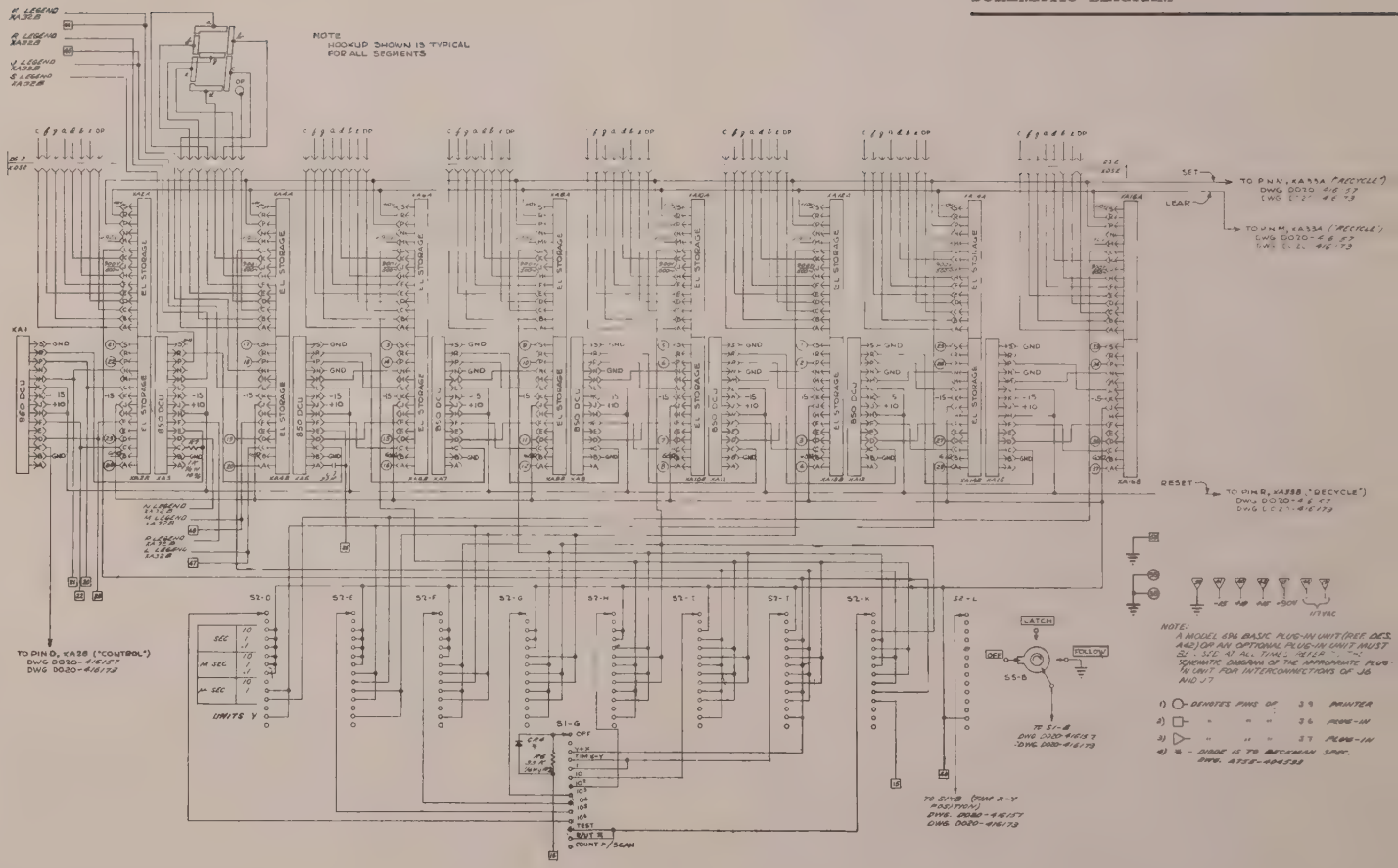
MISCELLANEOUS PARTS
(Model 6144 Count Logic)

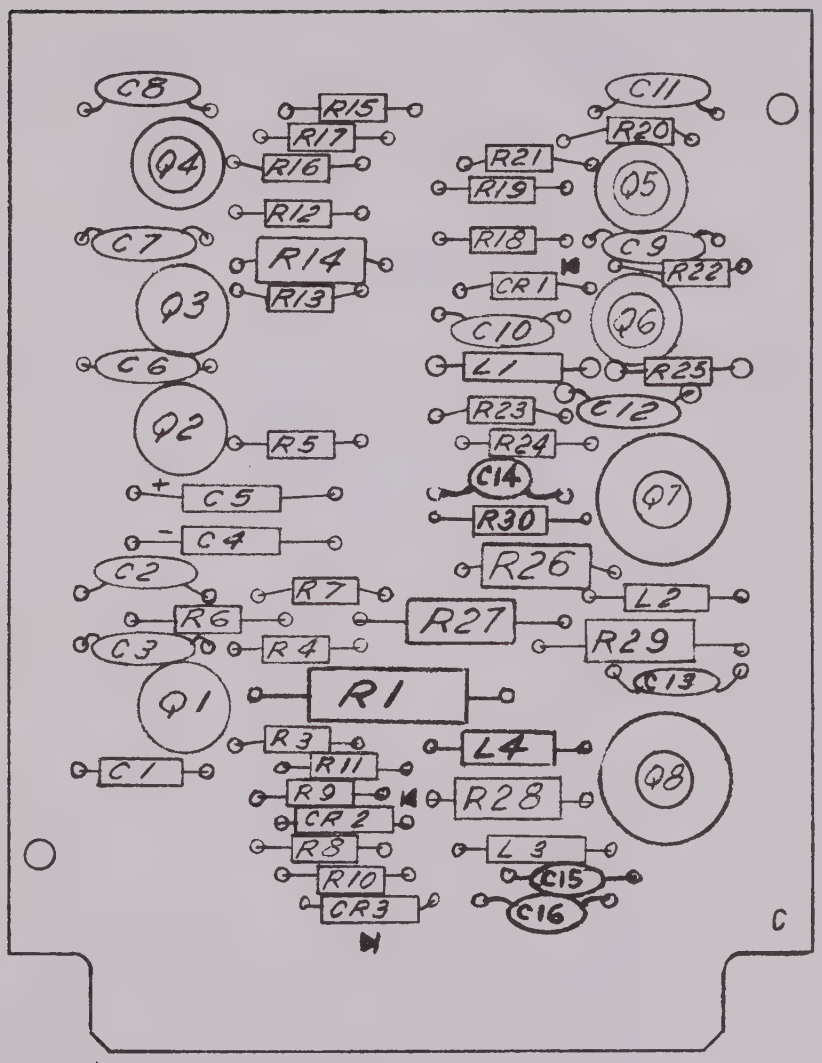
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C6 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V, 10% | Sprague 29C9B5 | 1 |
| C7 | 637-824008 | Capacitor, F. Mica, 22pf, 300V, 5% | Arco DM-16C220J-300 | 1 |
| CR4 | 755-404593 | Diode, Special | Beckman | 1 |
| DS2 | 823-412941 | Readout, E. L., Eight Digit | Beckman | 1 |
| R4 | 601-823923 | Resistor, F. Comp., 33Ω, 1/4W, 10% | Allen Bradley CB3301 | 1 |
| R5 | 601-823921 | Resistor, F. Comp., 22Ω, 1/4W, 10% | Allen Bradley CB2201 | 1 |
| R6 | 601-823109 | Resistor, F. Comp., 33K, 1/4W, 10% | Allen Bradley CB3301 | 1 |
| R7 | 601-823111 | Resistor, F. Comp., 1K, 1/4W, 10% | Allen Bradley CB1021 | 1 |
| XDS2 | 697-412938 | Socket, 8-Digit Electroluminescent Panel | Beckman | 1 |




MODE SWITCH AND COMPONENT ASSEMBLY, S1
(Dwg. No. C414795 - A)

MODEL 6144
COUNT LOGIC
SCHEMATIC DIAGRAM


NOTE
HOOKUP SHOWN IS TYPICAL FOR ALL SEGMENTS
SET
CLEAR
RESET
LATCH
FOLLOW
TO PIN D, KA28 ("CONTROL")
DWG D020-416157
DWG D020-416172
UNITS Y
TO S1-B (TIME X-Y POSITION)
DWG. D020-416157
DWG D020-416172
NOTE:
A MODEL 694 BASIC PLUG-IN UNIT (REF. DES. A8E) OR ANY OPTIONAL PLUG-IN UNIT MUST BE SEE AT ALL TIMES. REFER TO SCHEMATIC DIAGRAM OF THE APPROPRIATE PLUG-IN UNIT FOR INTERCONNECTIONS OF J6 AND J7
1) ○ DENOTES PINS OF 39 PRINTER
2) □ " " " 36 PLUG-IN
3) ▷ " " " 37 PLUG-IN
4) % - DIODE IS TO BECKMAN SPEC. DWG. A758-404533




2.5 MHz INPUT AMPLIFIER
COMPONENT LAYOUT (A17 & A18)

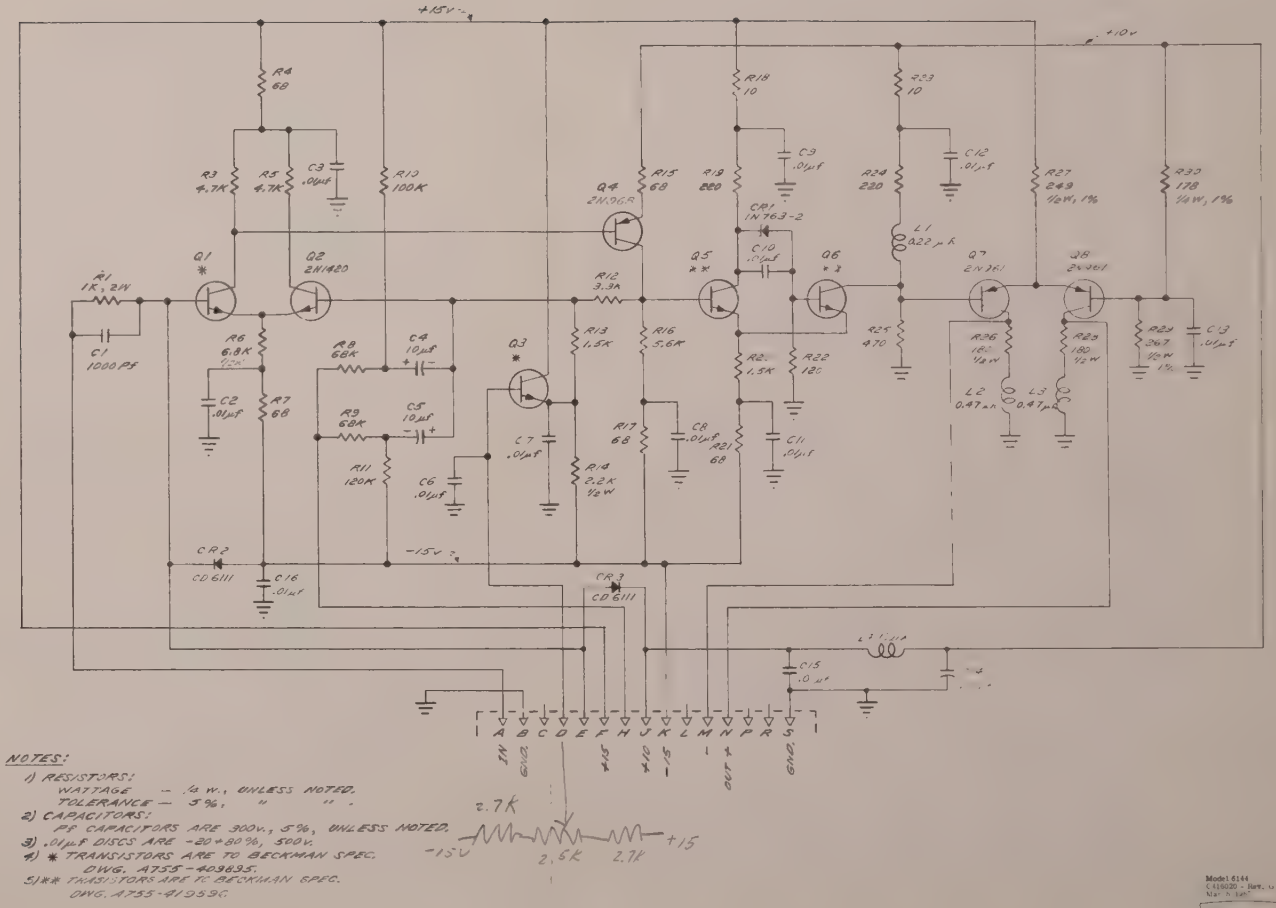
## 2.5 MHz INPUT AMPLIFIER (A17 & A18)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A17 (Input Y) A18 (Input X) | 887-410929 | 2.5 MHz Input Amplifier Board | Beckman | 2 |
| C1 | 637-824028 | Capacitor, F. Mica, 1000pf, 300V, 5% | Elmenco DM16E102J-300 | 1 |
| C2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V, -20, +80% | Sprague 29C9B5 | 13 |
| C4, 5 | 631-824631 | Capacitor, F. Elect., 10μf, 20V, 20% | Fansteel STA-621-1 | 2 |
| CR1 | 755-819903 | Diode, Zener, Silicon, 7V | Transistron 1N763-2 | 1 |
| CR2, 3 | 755-815561 | Diode, Silicon, 75 PIV, 10ma, 1V min. fwd. | Continental CD6111 | 2 |
| L1 | 795-819899 | Inductor, Fixed, R. F., 0.22μH | Delavan, 1840-02 | 1 |
| L2, 3 | 795-819898 | Inductor, Fixed, R. F., 0.47μH | Delavan 1840-06 | 2 |
| L4 | 795-807878 | Inductor, Fixed, R. F., 0.010mH | National NA-10-0-1 | 1 |
| Q1, 3 | 755-409895 | Transistor, Special | Beckman | 2 |
| Q2 | 755-817964 | Transistor, Silicon, NPN, 600mW max. | P.S.I. 2N1420 | 1 |
| Q4 | 755-817587 | Transistor, Germ., PNP, 150mW max. | Motorola 2N968 | 1 |
| Q5, 6 | 755-419596 | Transistor, Special | Beckman | 2 |
| Q7, 8 | 755-817811 | Transistor, Germ., PNP, 150mW | Motorola 2N961 | 2 |
| R1 | 601-015449 | Resistor, F. Comp., 1.8K, 1/2W, 5% | Allen Bradley EB1825 | 1 |
| R2, 14 | 601-000897 | Resistor, F. Comp., 2.2K, 1/2W, 5% | Allen Bradley EB2225 | 2 |
| R3, 5 | 601-822297 | Resistor, F. Comp., 4.7K, 1/4W, 5% | Allen Bradley CB4725 | 2 |
| R4, 7, 15, 17, 21 | 601-823389 | Resistor, F. Comp., 68Ω, 1/4W, 5% | Allen Bradley CB6805 | 5 |
| R6 | 601-010942 | Resistor, F. Comp., 6.8K, 1/2W, 5% | Allen Bradley EB6825 | 1 |
| R8, 9 | 601-822798 | Resistor, F. Comp., 68K, 1/4W, 5% | Allen Bradley CB6835 | 2 |
| R10 | 601-823904 | Resistor, F. Comp., 100K, 1/4W, 5% | Allen Bradley CB1045 | 1 |
| R11 | 601-823905 | Resistor, F. Comp., 120K, 1/4W, 5% | Allen Bradley CB1245 | 1 |
| R12 | 601-822296 | Resistor, F. Comp., 3.3K, 1/4W, 5% | Allen Bradley CB3325 | 1 |
| R13, 20 | 601-822527 | Resistor, F. Comp., 1.5K, 1/4W, 5% | Allen Bradley CB1525 | 2 |
| R16 | 601-823397 | Resistor, F. Comp., 5.6K, 1/4W, 5% | Allen Bradley CB5625 | 1 |
| R18, 23 | 601-823379 | Resistor, F. Comp., 10Ω, 1/4W, 5% | Allen Bradley CB1005 | 2 |

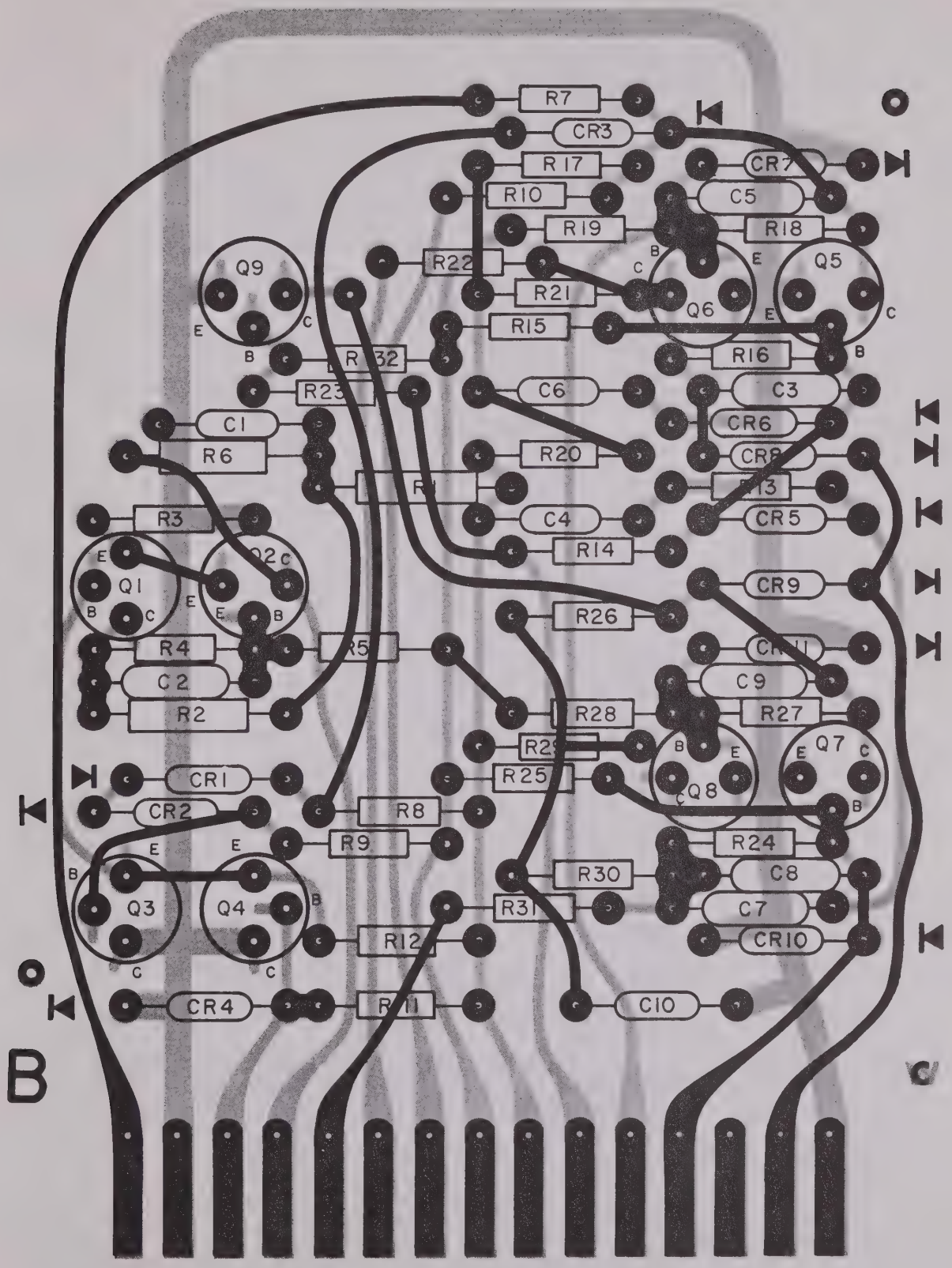
. . . continued

2.5MHz INPUT AMPLIFIER (A17 & A18) - continued

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| R19, 24 | 601-822327 | Resistor, F. Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 2 |
| R22 | 601-823390 | Resistor, F. Comp., 120Ω, 1/4W, 5% | Allen Bradley CB1215 | 1 |
| R25 | 601-823395 | Resistor, F. Comp., 470Ω, 1/4W, 5% | Allen Bradley CB4715 | 1 |
| R26, 28 | 601-024744 | Resistor, F. Comp., 180Ω, 1/2W, 5% | Allen Bradley EB1815 | 2 |
| R27 | 607-824997 | Resistor, F. Film, 249Ω, 1/2W, 1% | Inter Res. MEB-T-2-249-1% | 1 |
| R29 | 607-824996 | Resistor, F. Film, 267Ω, 1/2W, 1% | Inter Res. MEB-T-2-267-1% | 1 |
| R30 | 607-824998 | Resistor, F. Film, 178Ω, 1/4W, 1% | Inter Res. MEA-T-2-178-1% | 1 |
| | 776-827315 | Heat Sink | Birtcher 3AL635-5GR | 2 |
| | 864-412958 | Pad, Converter, Transistor | Beckman | 8 |



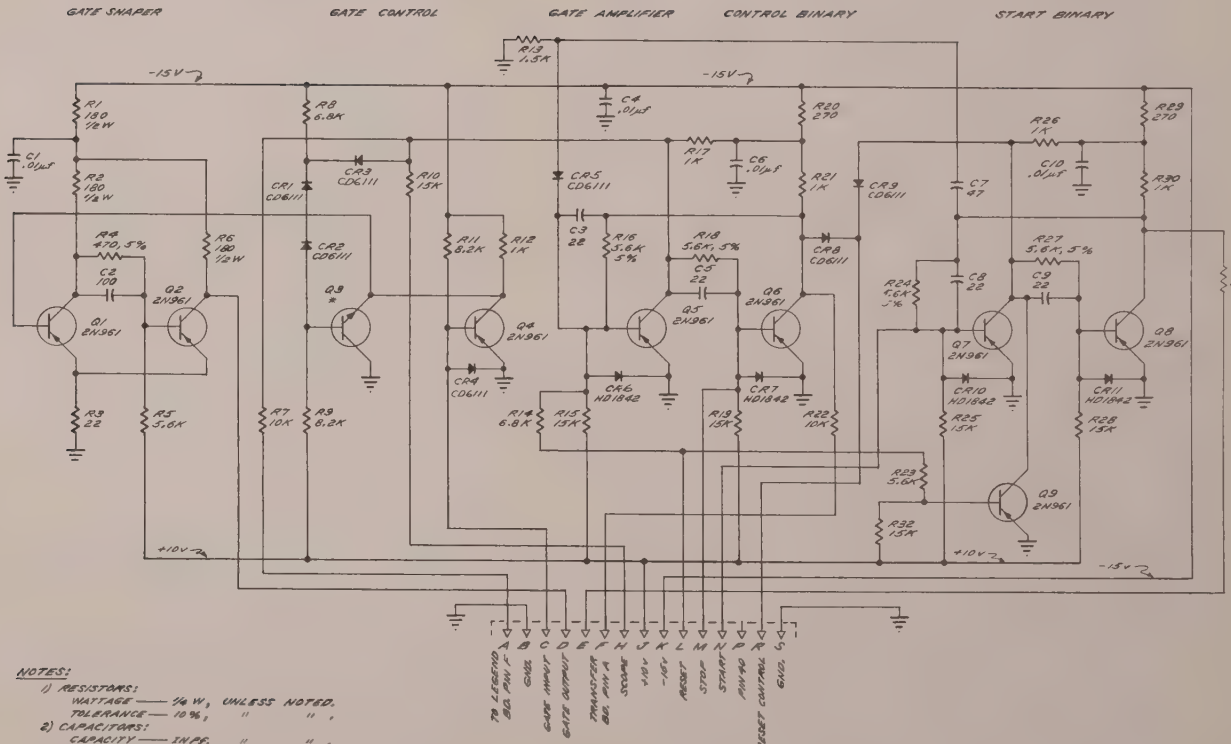

NOTES:
1) RESISTORS:
WATTAGE — 1/4 W., UNLESS NOTED.
TOLERANCE — 5%, " " .
2) CAPACITORS:
pf CAPACITORS ARE 300v., 5%, UNLESS NOTED.
3) .01µf DISCS ARE -20+80%, 500v.
4) * TRANSISTORS ARE TO BECKMAN SPEC. DWG. A755-409835.
5) ** TRANSISTORS ARE TO BECKMAN SPEC. DWG. A755-412596.




CONTROL COMPONENT LAYOUT (A28)

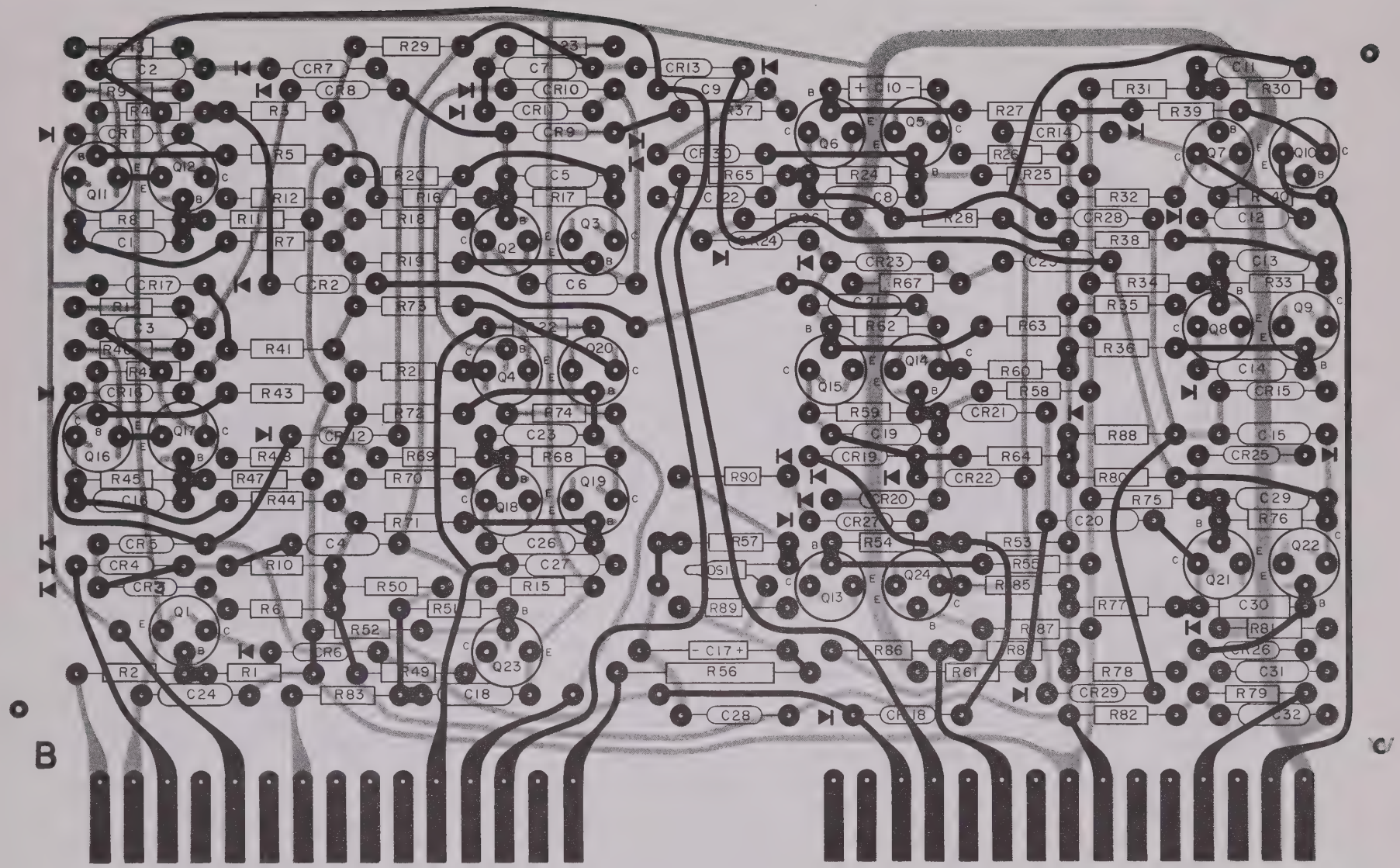
## CONTROL BOARD (A28)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A28 | 887-410903 | Control Board | Beckman | 1 |
| C1, 4, 6, 10 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 4 |
| C2 | 637-824016 | Capacitor, F. Mica, 100pf, 300V, 5% | Arco DM16E101J-300 | 1 |
| C3, 5, 8, 9 | 637-824008 | Capacitor F. Mica 22pf, 300V 5% | Arco DM16C220J-300 | 4 |
| C7 | 637-824012 | Capacitor, F. Mica, 47pf 300V, 5% | Arco DM16E470J-300 | 1 |
| CR1, 2, 3, 4, 5, 8, 9 | 755-815561 | Diode Silicon, 75PIV 10ma, 1V min. fwd. | Continental CD6111 | 7 |
| CR6, 7, 10, 11 | 755-824300 | Diode, Germanium | Hughes HD1842 | 4 |
| Q1, 2, 4, 5, 6, 7, 8, 9 | 755-817811 | Transistor, Germanium PNP 150mw | Motorola 2N961 | 8 |
| Q3 | 755-419596 | Transistor, Special | Beckman | 1 |
| R1, 2, 6 | 601-008068 | Resistor, F. Comp., 180Ω, 1/2W, 10% | Allen Bradley EB1811 | 3 |
| R3 | 601-823921 | Resistor, F. Comp., 22Ω, 1/4W, 10% | Allen Bradley CB2201 | 1 |
| R4 | 601-823395 | Resistor, F. Comp., 470Ω, 1/4W, 5% | Allen Bradley CB4715 | 1 |
| R5, 23 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 10% | Allen Bradley CB5621 | 2 |
| R7, 22 | 601-823108 | Resistor, F. Comp., 10K, 1/4W, 10% | Allen Bradley CB1031 | 2 |
| R8, 14, 31 | 601-823945 | Resistor, F. Comp. 6.8K, 1/4W, 10% | Allen Bradley CB6821 | 3 |
| R9, 11 | 601-823946 | Resistor, F. Comp., 8.2K, 1/4W, 10% | Allen Bradley CB8221 | 2 |
| R10, 15, 19, 25, 28, 32 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 6 |
| R12, 17, 21, 26, 30 | 601-823111 | Resistor, F. Comp., 1K, 1/4W, 10% | Allen Bradley CB1021 | 5 |
| R13 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 1 |
| R16, 18, 24, 27 | 601-822397 | Resistor, F. Comp., 5.6K, 1/4W 5% | Allen Bradley CB5625 | 4 |
| R20, 29 | 601-823934 | Resistor, F. Comp., 270Ω, 1/4W, 10% | Allen Bradley CB2711 | 2 |
| | 864-412958 | Pad, Transistor | Beckman | 8 |




NOTES:

1) RESISTORS:
   WATTAGE — 1/4 W, UNLESS NOTED.
   TOLERANCE — 10%, " "
2) CAPACITORS:
   CAPACITY — IN PF, " "
   VOLTAGE — 300 V, " "
   TOLERANCE — 5%, " "
3) .01µf DISC ARE -80 +80%, 500V.
4) * TRANSISTOR-TO BECKMAN SPEC. 855-619596




RECYCLE COMPONENT LAYOUT (A33)



Model 6144
64C-6100-024-Rev. J
March 1967

Beckman®

## RECYCLE BOARD (A33)

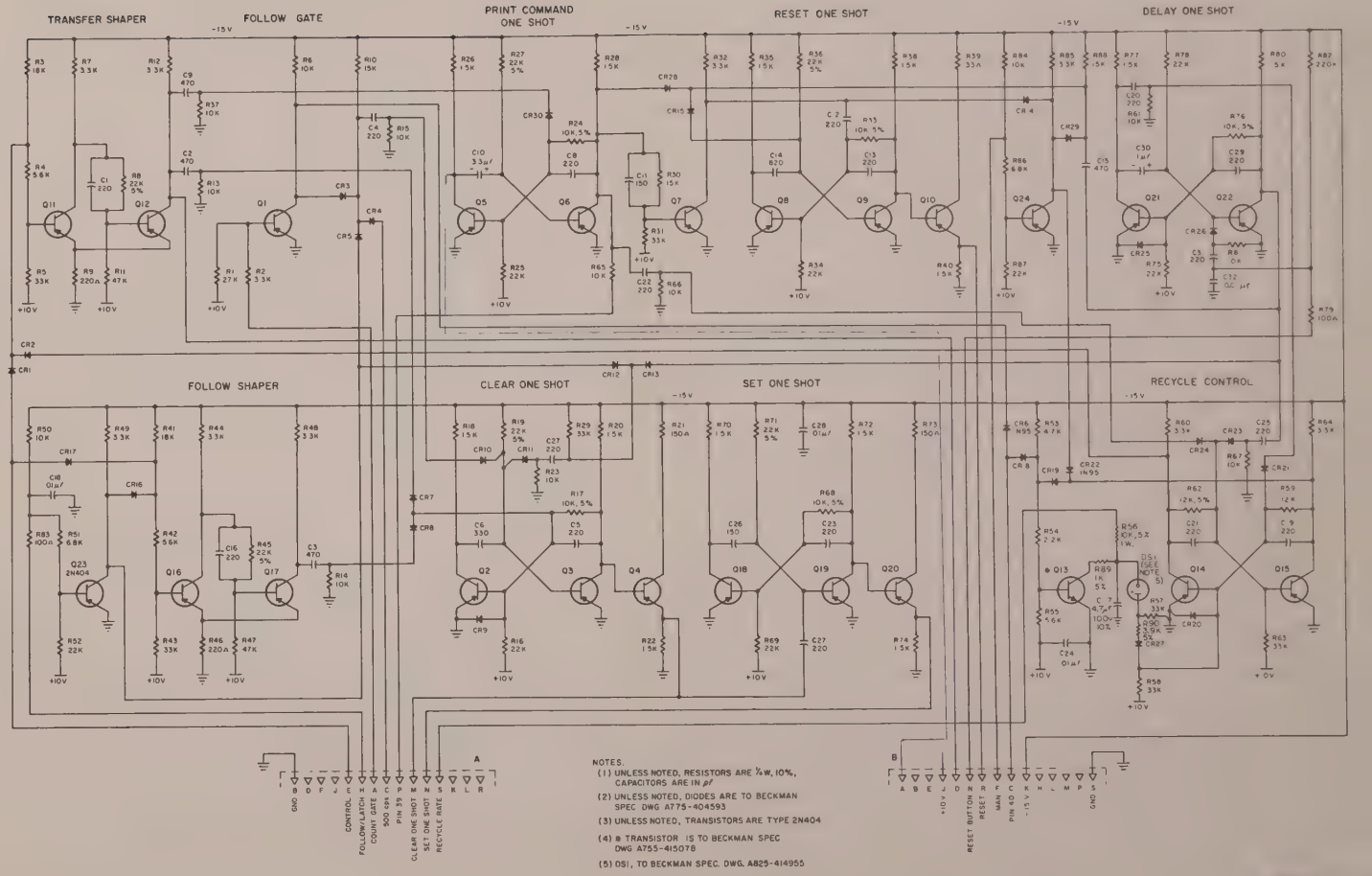
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A33 | 887-411673 | Recycle Board | Beckman | 1 |
| C1, 4, 5, 7, 8, 12, 13, 16, 19, 20, 21, 22, 23, 25, 27, 29, 31 | 637-824020 | Capacitor, F. Mica, 220pf, | Arco DM16E221J-300 | 17 |
| C2, 3, 9, 15 | 637-824024 | Capacitor, F. Mica, 470pf, 300V, 5% | Arco DM16E471J-300 | 4 |
| C6 | 637-824022 | Capacitor, F. Mica, 330pf, 300V, 5% | Arco DM16E331J-300 | 1 |
| C10 | 631-819463 | Capacitor, F. Elect., 3.3μf, 15V, 10% | Fansteel STA5123-1 | 1 |
| C11, 26 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Arco DM16E151J-300 | 2 |
| C14 | 637-824027 | Capacitor, F. Mica, 820pf, 300V, 5% | Arco DM16E821J-300 | 1 |
| C17 | 631-828102 | Capacitor, F. Elect., 4.7μf, 100V | Fansteel SP120-11 | 1 |
| C18, 24, 28, 32 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 4 |
| C30 | 631-814053 | Capacitor, F. Elect., 1μf, 35V, 20% | Sprague 150D105X0035A2 | 1 |
| CR1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30 | 755-404593 | Diode, Special | Beckman | 27 |
| CR6, 14, 22 | 755-402107 | Diode, Special | Beckman | 3 |
| DS1 | 825-414955 | Lamp, Neon, Special | Beckman | 1 |
| Q1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 | 755-800398 | Transistor, Germ., PNP, 150mW max. | Sylvania 2N404 | 23 |
| Q13 | 755-415078 | Transistor, Special | Beckman | 1 |
| R1 | 601-823949 | Resistor, F. Comp., 27K, 1/4W, 10% | Allen Bradley CB2731 | 1 |
| R2, 7, 12, 32, 44, 48, 49, 60, 64, 85 | 601-823942 | Resistor, F. Comp., 3.3K, 1/4W, 10% | Allen Bradley CB3321 | 10 |
| R3, 41 | 601-823948 | Resistor, F. Comp., 18K, 1/4W, 10% | Allen Bradley CB1821 | 2 |
| R4, 42 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 10% | Allen Bradley CB5621 | 2 |
| R5, 29, 31, 43, 57, 58, 63 | 601-823109 | Resistor, F. Comp., 33K, 1/4W, 10% | Allen Bradley CB3331 | 7 |
| R6, 13, 14, 15, 23, 37, 50, 61, 65, 66, 67, 81, 84 | 601-823108 | Resistor, F. Comp., 10K, | Allen Bradley CB1031 | 13 |
| R8, 19, 27, 36, 45, 71 | 601-822334 | Resistor, F. Comp., 22K, 1/4W, 5% | Allen Bradley CB2235 | 6 |
| R9, 46 | 601-823933 | Resistor, F. Comp., 220Ω, | Allen Bradley CB2211 | 2 |

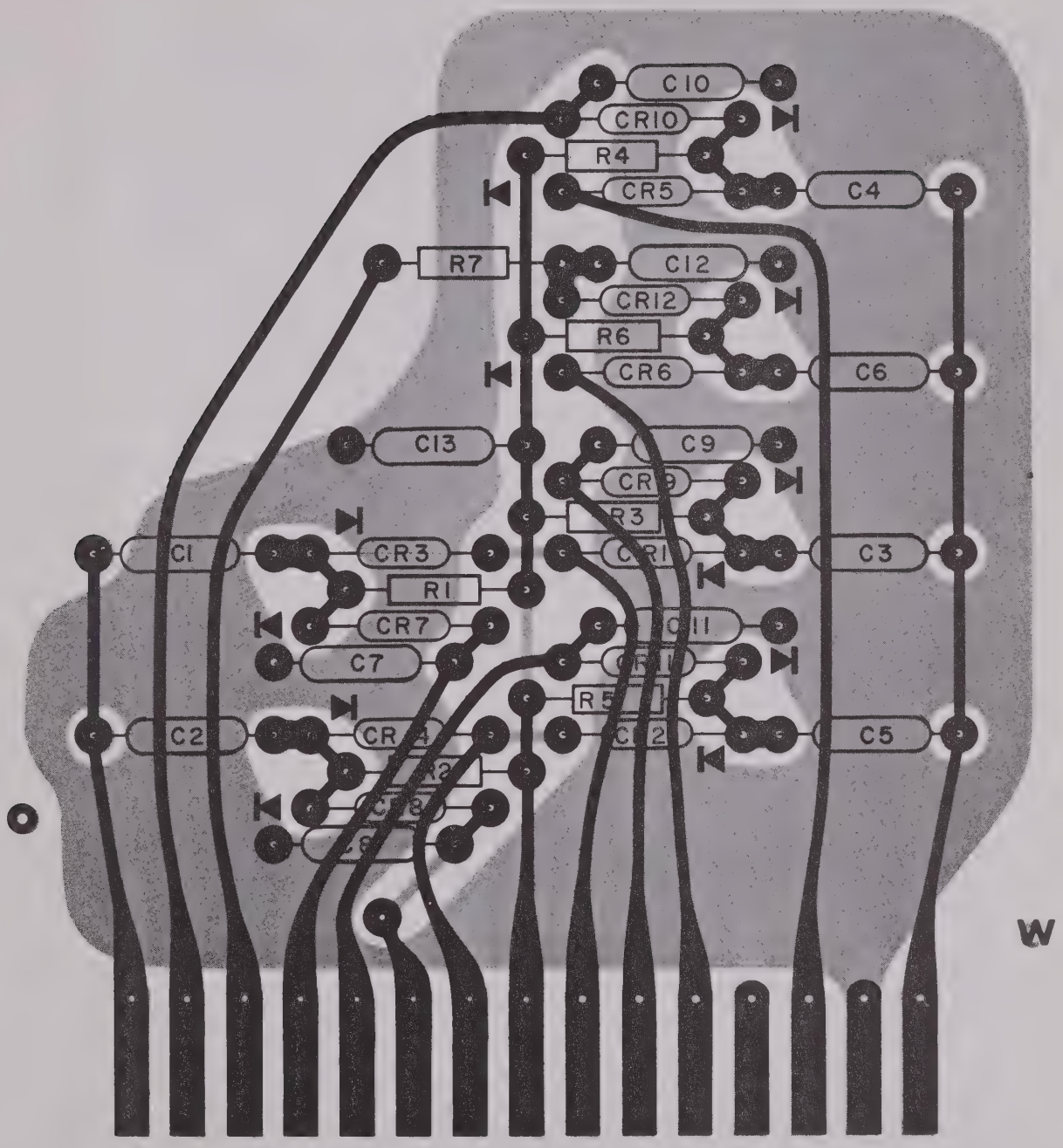
. . . continued

RECYCLE BOARD (A33) - continued

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| R10, 30, 88 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 3 |
| R11, 47 | 601-823951 | Resistor, F. Comp., 47K, 1/4W, 10% | Allen Bradley CB4731 | 2 |
| R16, 25, 34, 52, 69, 75, 78, 87 | 601-823110 | Resistor, F. Comp., 22K, 1/4W, 10% | Allen Bradley CB2231 | 8 |
| R17, 24, 33, 68, 76 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 5 |
| R18, 20, 22, 26, 28, 35, 38, 40, 70, 72, 74, 77, 80 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 13 |
| R21, 73 | 601-823931 | Resistor, F. Comp., 150Ω, 1/4W, 10% | Allen Bradley CB1511 | 2 |
| R39 | 601-823923 | Resistor, F. Comp., 33Ω, 1/4W, 10% | Allen Bradley CB3301 | 1 |
| R51, 86 | 601-823945 | Resistor, F. Comp., 6.8K, 1/4W, 10% | Allen Bradley CB6821 | 2 |
| R53 | 601-815239 | Resistor, F. Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 1 |
| R54 | 601-812856 | Resistor, F. Comp., 2.2K, 1/4W, 10% | Allen Bradley CB2221 | 1 |
| R55 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 5% | Allen Bradley CB5625 | 1 |
| R56 | 601-043209 | Resistor, F. Comp., 10K, 1W, 5% | Allen Bradley GB1035 | 1 |
| R59 | 601-823947 | Resistor, F. Comp., 12K, 1/4W, 10% | Allen Bradley CB1231 | 1 |
| R62 | 601-822333 | Resistor, F. Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 1 |
| R79, 83 | 601-823929 | Resistor, F. Comp., 100Ω, 1/4W, 10% | Allen Bradley CB1011 | 2 |
| R82 | 601-812742 | Resistor, F. Comp., 220K, 1/4W, 10% | Allen Bradley CB2241 | 1 |
| R89 | 601-822308 | Resistor, F. Comp., 1K, 1/4W, 5% | Allen Bradley CB1025 | 1 |
| R90 | 601-823943 | Resistor, F. Comp., 3.9K, 1/4W, 10% | Allen Bradley CB3925 | 1 |
| | 864-412958 | Pad, Transistor | Beckman | 24 |

RECYCLE (A33)
SCHEMATIC DIAGRAM

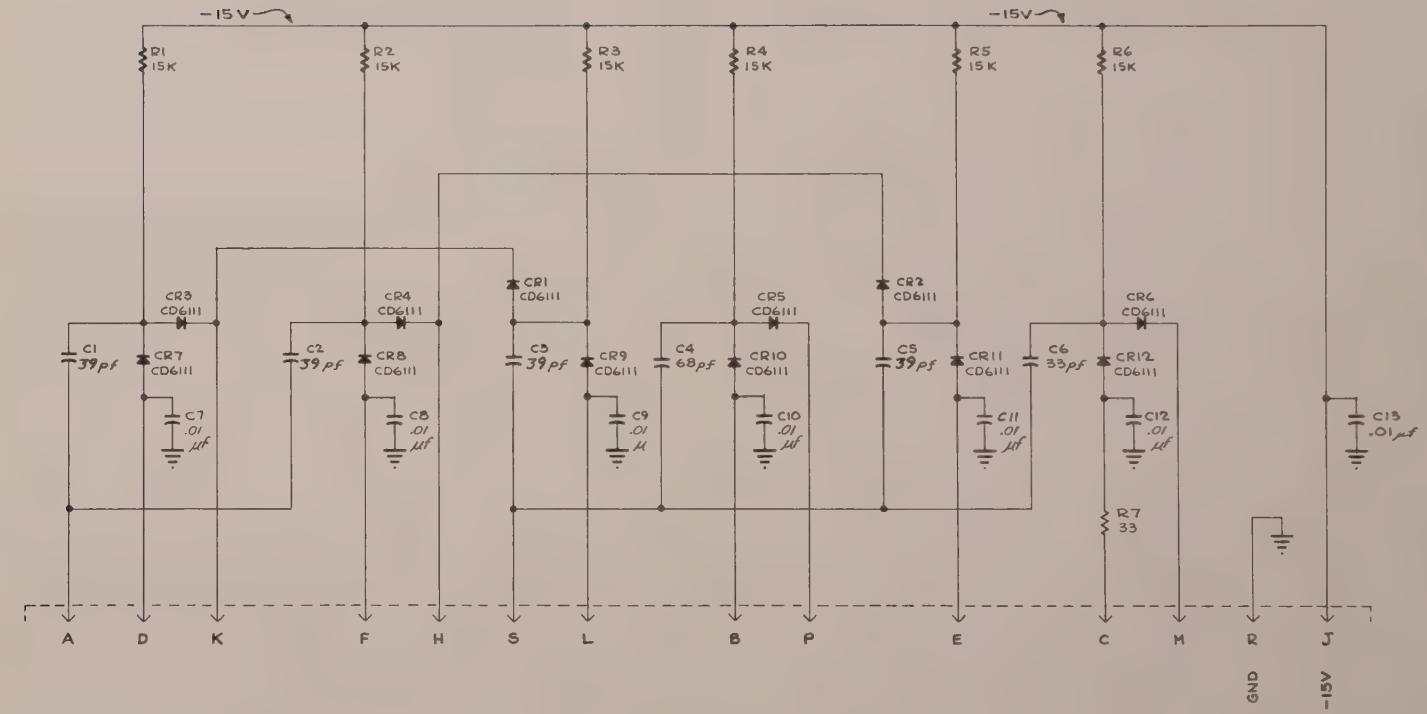

TRANSFER SHAPER
FOLLOW GATE
PRINT COMMAND ONE SHOT
RESET ONE SHOT
DELAY ONE SHOT
FOLLOW SHAPER
CLEAR ONE SHOT
SET ONE SHOT
RECYCLE CONTROL
NOTES.
(1) UNLESS NOTED, RESISTORS ARE ¼W, 10%, CAPACITORS ARE IN pf
(2) UNLESS NOTED, DIODES ARE TO BECKMAN SPEC DWG A775-404593
(3) UNLESS NOTED, TRANSISTORS ARE TYPE 2N404
(4) ⊕ TRANSISTOR IS TO BECKMAN SPEC DWG A755-415078
(5) DS1, TO BECKMAN SPEC. DWG. A825-414955




B LOGIC COMPONENT LAYOUT (A27)

## B LOGIC BOARD (A27)

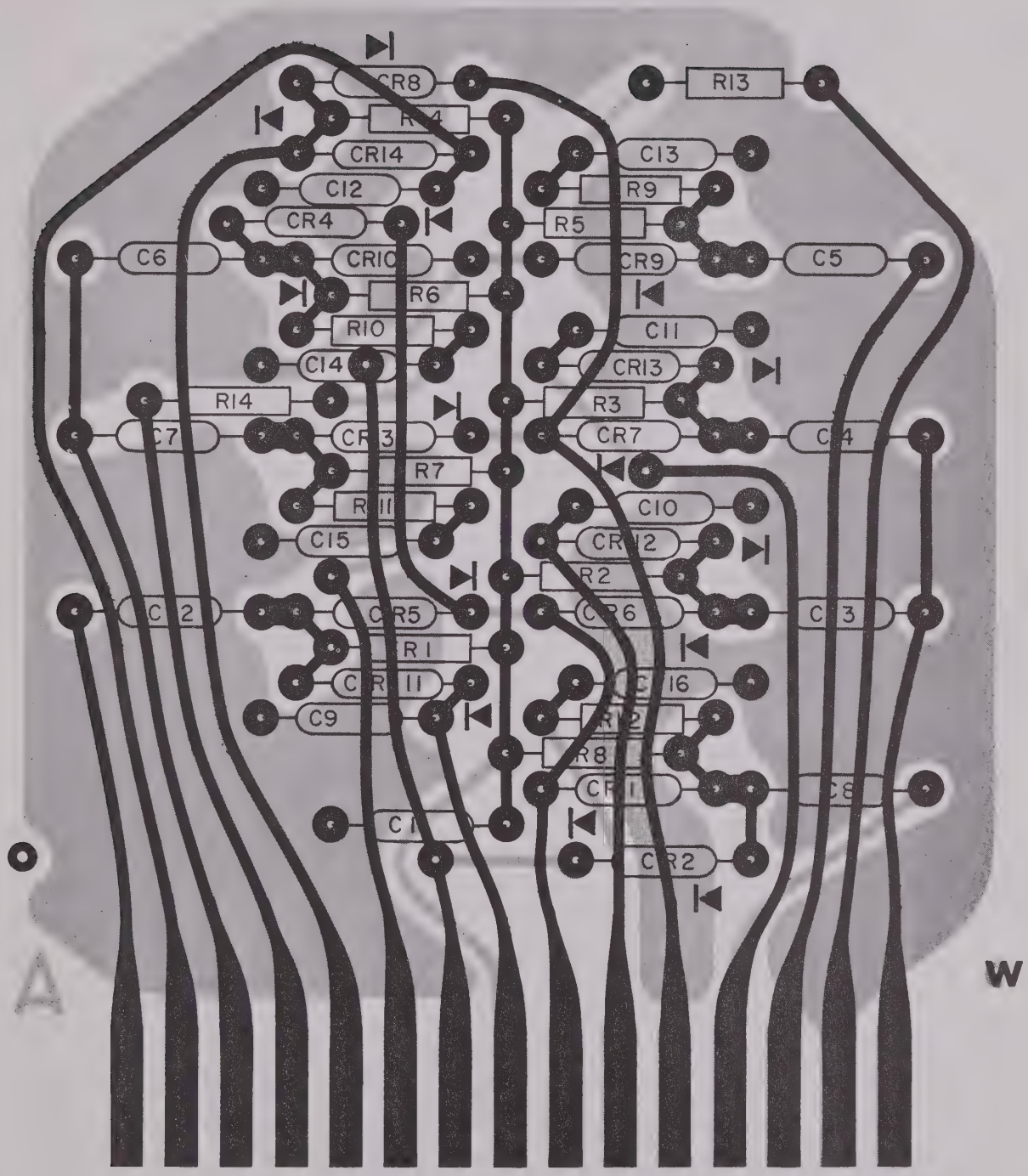
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A27 | 887-412559 | B Logic Board | Beckman | 1 |
| C1, 2, 3, 5 | 637-824011 | Capacitor, F. Mica, 39pf, 300V, 5% | Arco DM16C390J-300 | 4 |
| C4 | 637-824014 | Capacitor, F. Mica, 68pf, 300V, 5% | Arco DM16E680J-300 | 1 |
| C6 | 633-824010 | Capacitor, F. Cerm., 33pf, 300V, 5% | Arco DM16E330J-300 | 1 |
| C7, 8, 9, 10, 11, 12, 13 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 7 |
| CR1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 | 755-815561 | Diode, Silicon, 75PIV, 10ma, 1V min. fwd. | Continental CD6111 | 12 |
| R1, 2, 3, 4, 5, 6 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 6 |
| R7 | 601-823923 | Resistor, F. Comp., 33Ω, 1/4W, 10% | Allen Bradley CB3301 | 1 |




NOTE:
RESISTORS:
WATTAGE — 1/4 W, UNLESS NOTED.
TOLERANCE — 10%, " "
CAPACITORS:
VOLTAGE — 300v, " "
TOLERANCE — 5%, " "
.01 µf DISCS ARE -20 +80%, 500 v

Model 6144
C412443 - Rev. B
March 1967

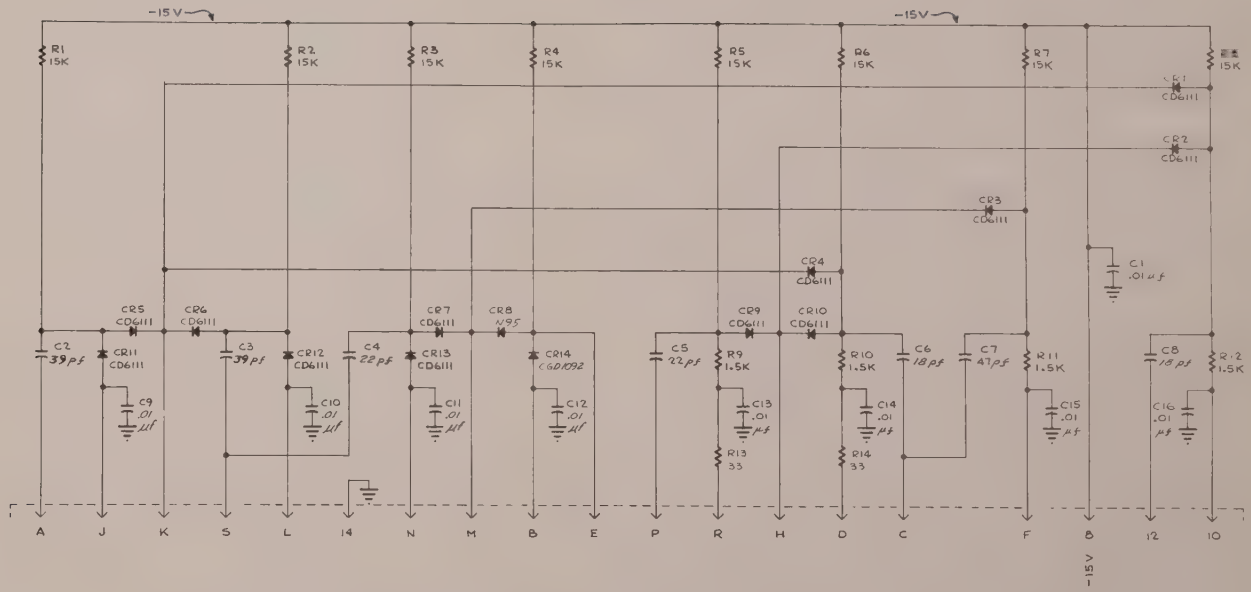
Beckman




F LOGIC COMPONENT LAYOUT (A26)

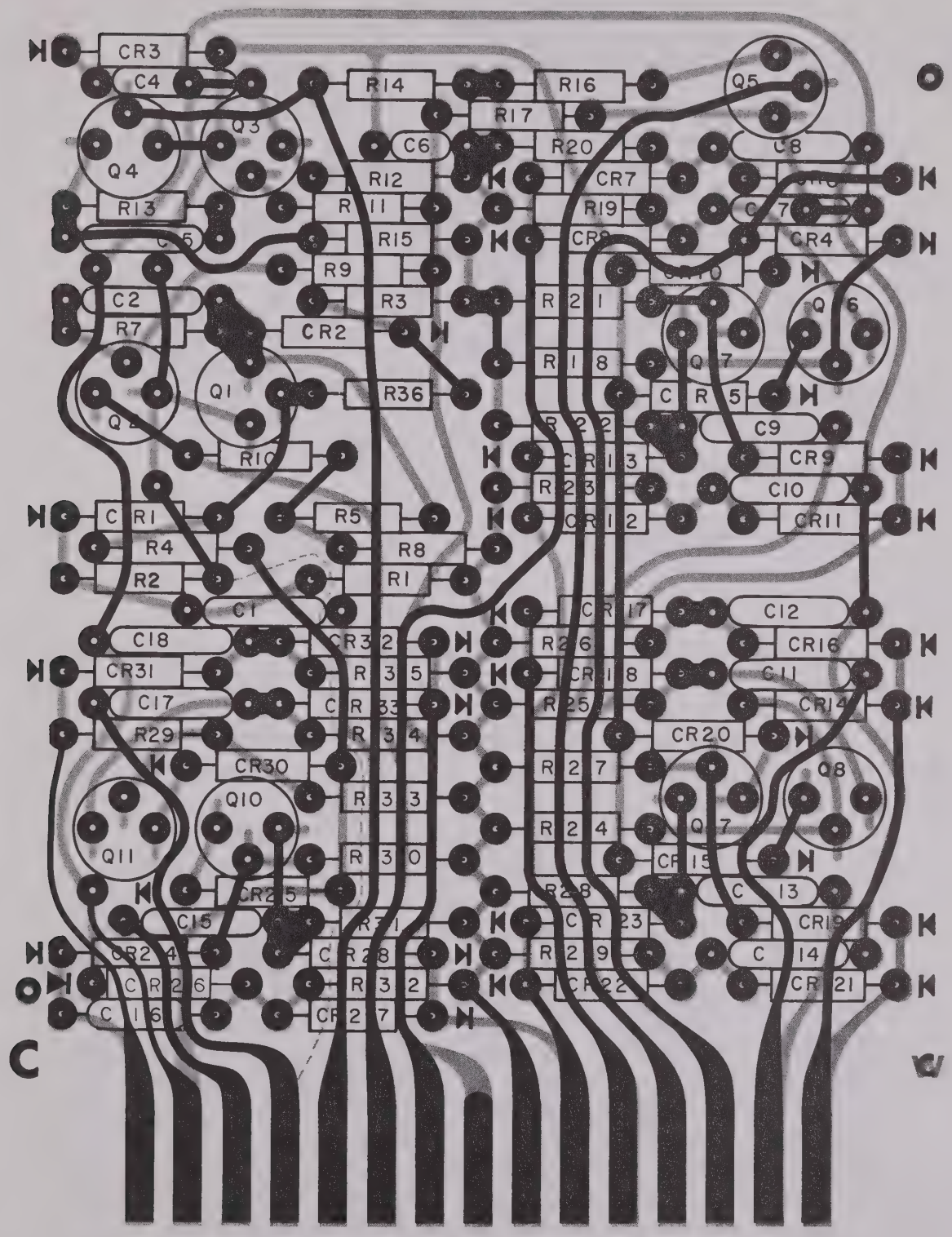
## F LOGIC BOARD (A26)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A26 | 887-412126 | F Logic Board | Beckman | 1 |
| C1, 9, 10, 11, 12, 13, 14, 15, 16 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 9 |
| C2, 3 | 637-824011 | Capacitor, F. Mica, 39pf, 300V, 5% | Arco DM16C390J-300 | 2 |
| C4, 5 | 637-824008 | Capacitor, F. Mica, 22pf, 300V, 5% | Arco DM16E220J-300 | 2 |
| C6, 8 | 637-824007 | Capacitor, F. Mica, 18pf, 300V, 5% | Arco DM16C180J-300 | 2 |
| C7 | 637-824012 | Capacitor, F. Mica, 47pf, 300V, 5% | Arco DM16E470J-300 | 1 |
| CR1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13 | 755-815561 | Diode, Silicon, 75PIV, 10ma, 1V min. fwd. | Continental CD6111 | 12 |
| CR8 | 755-402107 | Diode, Special | Beckman | 1 |
| CR14 | 755-817812 | Diode, Germ., 15PIV, 100ma, 1V min. fwd. | Clevite CGD-1092 | 1 |
| R1, 2, 3, 4, 5, 6, 7, 8 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 8 |
| R9, 10, 11, 12 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 4 |
| R13, 14 | 601-823923 | Resistor, F. Comp., 33Ω, 1/4W, 10% | Allen Bradley CB3301 | 2 |




NOTE:
1) RESISTORS:
WATTAGE — 1/4W, UNLESS NOTED
TOLERANCE — 10%, " "
2) CAPACITORS:
CAPACITY — IN PF, " "
VOLTAGE — 300 V, " "
TOLERANCE — 5%, " "
3) .01µf DISC ARE -20+80%, 500V

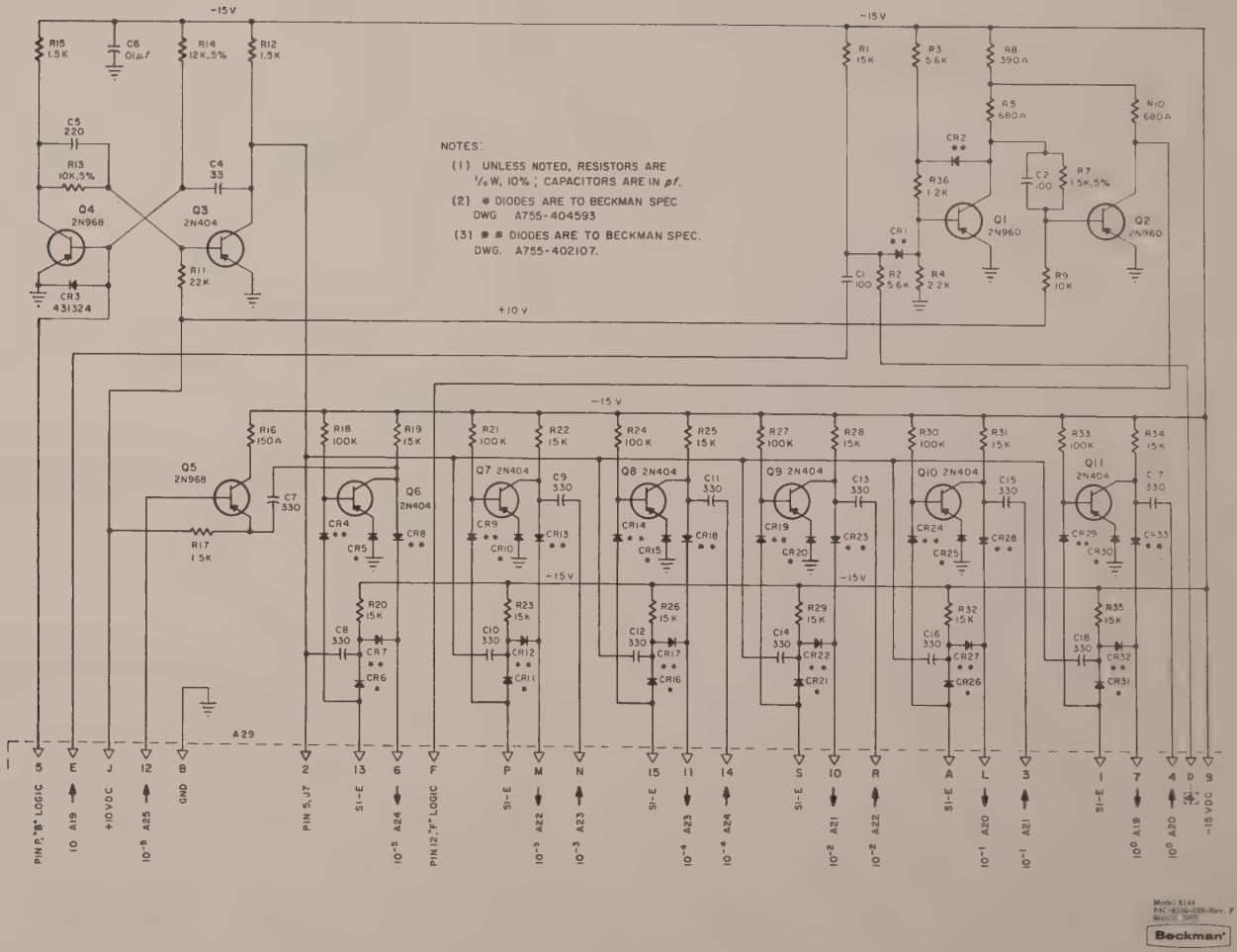
Model 5144
C412112-Rev. D
March 1967
Beckman

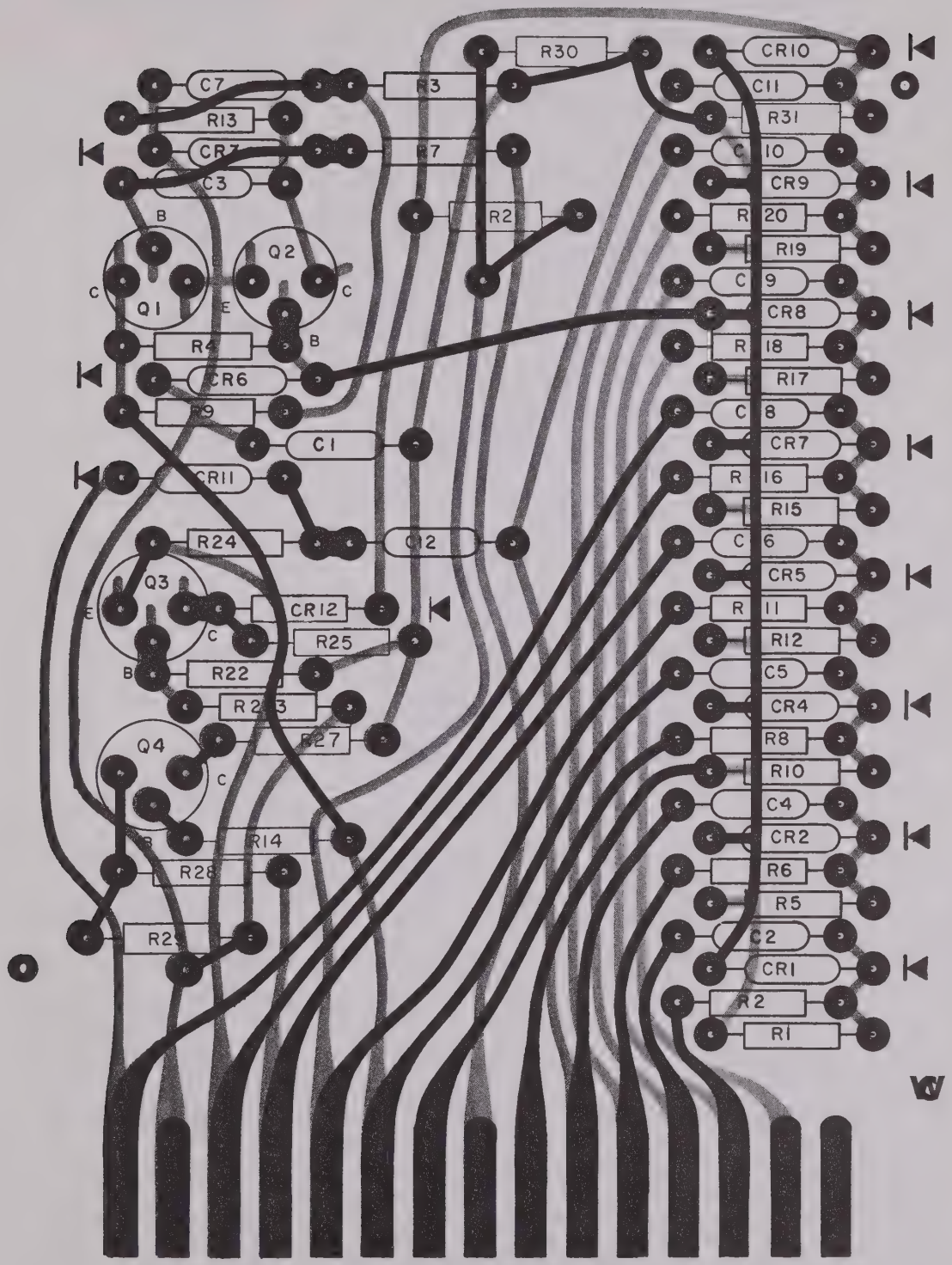



M LOGIC COMPONENT LAYOUT (A29)

## M LOGIC BOARD (A29)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A29 | 887-416904 | M Logic Board | Beckman | 1 |
| C1, 2 | 637-824016 | Capacitor, F. Mica, 100pf, 300V, 5% | Arco DM16E101J-300 | 2 |
| C4 | 637-824010 | Capacitor, F. Mica, 33pf, 300V, 5% | Arco DM16E330J-300 | 1 |
| C5 | 637-824020 | Capacitor, F. Mica, 220pf, 300V, 5% | Arco DM16E221J-300 | 1 |
| C6 | 633-804715 | Capacitor, F. Cerm., 0.01μf, 50V | Sprague 19C214 | 1 |
| C7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18 | 637-824022 | Capacitor, F. Mica, 330pf, 300V, 5% | Arco DM16E331J-300 | 11 |
| C16 | 637-822908 | Capacitor, F. Mica, 330pf, 500V, 5% | Electromotive DM15C-331J-500 | 1 |
| CR1, 2, 4, 7, 8, 9, 12, 13, 14, 17, 18, 19, 22, 23, 24, 27, 28, 29, 32, 33 | 755-402107 | Diode, Special | Beckman | 20 |
| CR3 | 755-431324 | Diode, Special | Beckman | 1 |
| CR5, 6, 10, 11, 15, 16, 20, 21, 25, 26, 30, 31 | 755-404593 | Diode, Special | Beckman | 12 |
| Q1, 2 | 755-824880 | Transistor, Germanium, PNP, 150mw | Motorola 2N960 | 2 |
| Q3, 6, 7, 8, 9, 10, 11 | 755-800398 | Transistor, Germanium, PNP, 150mw max. | Sylvania 2N404 | 7 |
| Q4, 5 | 755-817587 | Transistor, Germanium, PNP, 150mw | Motorola 2N968 | 2 |
| R1, 19, 20, 22, 23, 25, 26, 28, 29, 31, 32, 34, 35 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 13 |
| R2, 3 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 10% | Allen Bradley CB5621 | 2 |
| R4 | 601-812856 | Resistor, F. Comp., 2.2K, 1/4W, 10% | Allen Bradley CB2221 | 1 |
| R5, 10 | 601-823937 | Resistor, F. Comp., 680Ω, 1/4W, 10% | Allen Bradley CB6811 | 2 |
| R7 | 601-822527 | Resistor, F. Comp., 1.5K, 1/4W, 5% | Allen Bradley CB1525 | 1 |
| R8 | 601-822371 | Resistor, F. Comp., 390Ω, 1/4W, 5% | Allen Bradley CB3915 | 1 |
| R9 | 601-823108 | Resistor, F. Comp., 10K, 1/4W, 10% | Allen Bradley CB1525 | 1 |
| R11 | 601-823110 | Resistor, F. Comp., 22K, 1/4W, 10% | Allen Bradley CB2231 | 1 |
| R12, 15, 17 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 3 |
| R13 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 1 |
| R14 | 601-822333 | Resistor, F. Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 1 |
| R16 | 601-823931 | Resistor, 150Ω, 1/4W, 10% | Allen Bradley CB1511 | 1 |
| R18, 21, 24, 27, 30, 33 | 601-812741 | Resistor, F. Comp., 100K, 1/4W, 10% | Allen Bradley CB1041 | 6 |
| R36 | 601-823939 | Resistor, F. Comp., 1.2K, 1/4W, 10% | Allen Bradley CB1221 | 1 |
| | 864-412958 | Pad, Transistor | Beckman | 11 |

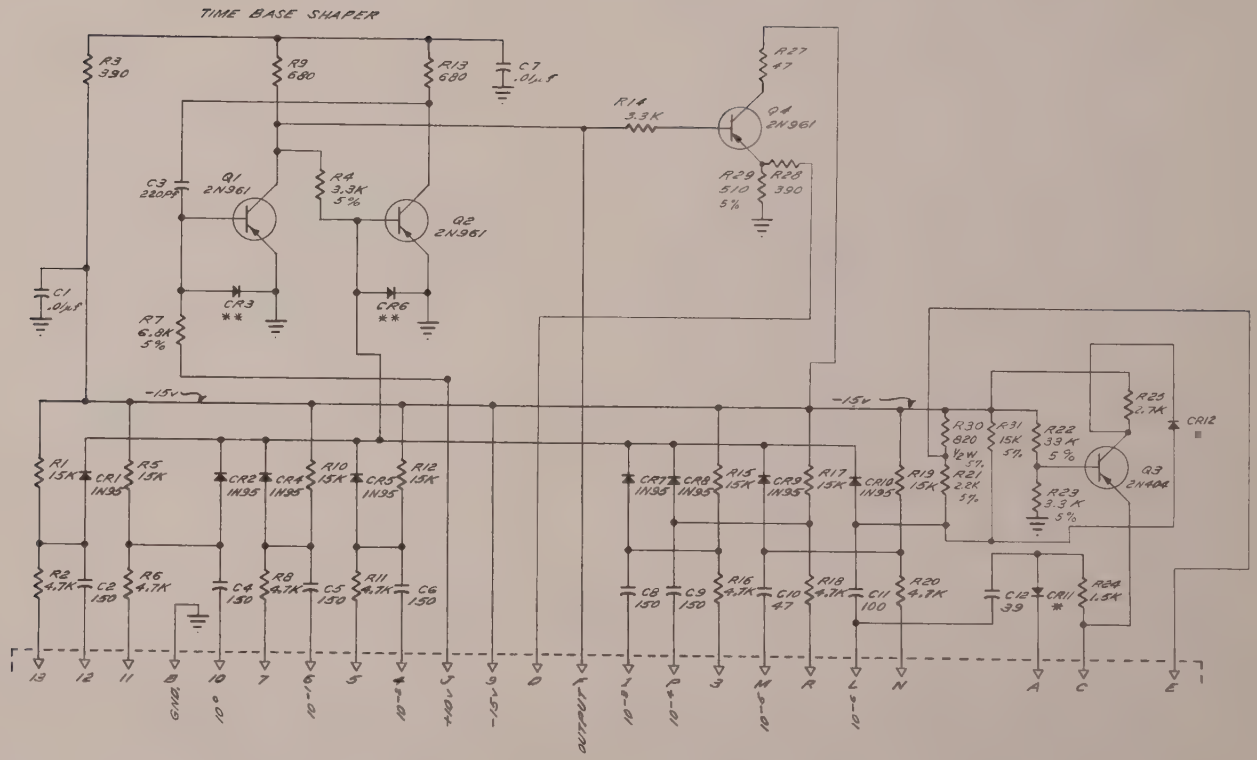

NOTES:
(1) UNLESS NOTED, RESISTORS ARE 1/4W, 10%; CAPACITORS ARE IN pf.
(2) * DIODES ARE TO BECKMAN SPEC DWG A755-404593
(3) * * DIODES ARE TO BECKMAN SPEC. DWG. A755-402107.
-15 V
+10 V
R15 1.5K
C6 .01μf
R14 12K,5%
R12 1.5K
C5 220
R13 10K,5%
C4 33
Q4 2N968
Q3 2N404
R11 22K
CR3 431324
R1 15K
R3 5.6K
R8 390Ω
R5 680Ω
R10 680Ω
CR2
R36 1.2K
C2 .100
R7 1.5K,5%
Q1 2N960
Q2 2N960
CR1
C1 100
R2 5.6K
R4 2.2K
R9 10K
Q5 2N968
C7 330
R17 1.5K
R16 150Ω
R18 100K
R19 15K
Q6 2N404
CR4
CR5
CR8
R20 15K
C8 330
CR7
CR6
R21 100K
R22 15K
Q7 2N404
C9 330
CR9
CR10
CR13
R23 15K
C10 330
CR12
CR11
R24 100K
R25 15K
Q8 2N404
C11 330
CR14
CR15
CR18
R26 15K
C12 330
CR17
CR16
R27 100K
R28 15K
Q9 2N404
C13 330
CR19
CR20
CR23
R29 15K
C14 330
CR22
CR21
R30 100K
R31 15K
Q10 2N404
C15 330
CR24
CR25
CR28
R32 15K
C16 330
CR27
CR26
R33 100K
R34 15K
Q11 2N404
C 7 330
CR29
CR30
CR33
R35 15K
C18 330
CR32
CR31
A29
PIN P, "B" LOGIC
10 A19
+10 VDC
10⁻⁵ A25
GND
PIN 5, J7
SI-E
10⁻⁵ A24
PIN 12, "F" LOGIC
SI-E
10⁻³ A22
10⁻³ A23
SI-E
10⁻⁴ A23
10⁻⁴ A24
SI-E
10⁻² A21
10⁻² A22
SI-E
10⁻¹ A20
10⁻¹ A21
SI-E
10⁰ A19
10⁰ A20
-15 VDC




TIME BASE LOGIC COMPONENT LAYOUT (A30)

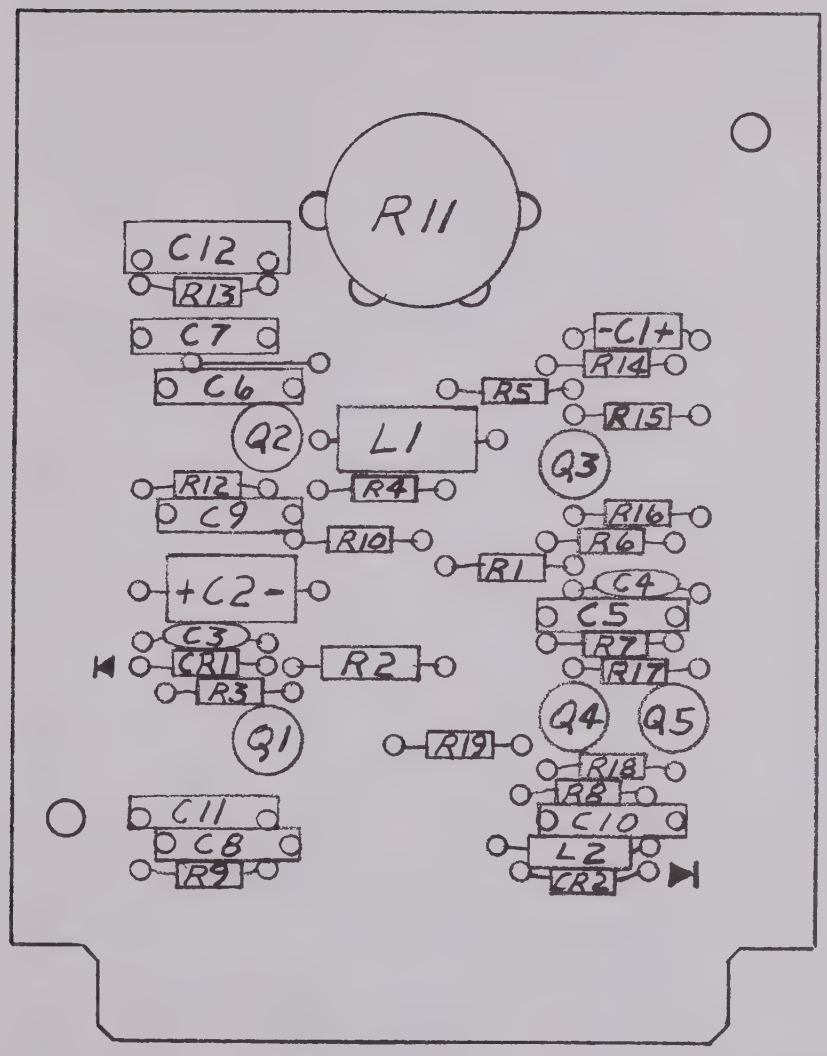
## TIME BASE LOGIC BOARD (A30)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A30 | 887-411674 | Time Base Logic Board | Beckman | 1 |
| C1, 7 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 2 |
| C2, 4, 5, 6, 8, 9 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Arco DM16E151J-300 | 6 |
| C3 | 637-824020 | Capacitor, F. Mica, 220pf, 300V, 5% | Arco DM16E221J-300 | 1 |
| C10 | 637-824012 | Capacitor, F. Mica, 47pf, 300V, 5% | Arco DM16E470J-300 | 1 |
| C11 | 637-824016 | Capacitor, F. Mica, 100pf, 300V, 5% | Arco DM16E101J-300 | 1 |
| C12 | 637-824011 | Capacitor, F. Mica, 39pf, 300V, 5% | Arco DM16E390J-300 | 1 |
| CR1, 2, 4, 5, 7, 8, 9, 10 | 755-402107 | Diode, Special | Beckman | 8 |
| CR3, 6 | 755-420893 | Diode, Special | Beckman | 2 |
| CR11 | 755-815561 | Diode, Silicon, 75PIV, 10ma, 1V min. fwd. | Continental CD6111 | 1 |
| CR12 | 755-431324 | Diode, Special | Beckman | 1 |
| Q1, 2, 4 | 755-817811 | Transistor, Germanium, PNP, 150mW | Motorola 2N961 | 3 |
| Q3 | 755-800398 | Transistor, Germanium, PNP 150mW max. | Sylvania 2N404 | 1 |
| R1, 5, 10, 12, 15, 17, 19 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 7 |
| R2, 6, 8, 11, 16, 18, 20 | 601-815239 | Resistor, F. Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 7 |
| R3, 28 | 601-823104 | Resistor, F. Comp., 390Ω, 1/4W, 10% | Allen Bradley CB3911 | 2 |
| R4, 23 | 601-822296 | Resistor, F. Comp., 3.3K, 1/4W, 5% | Allen Bradley CB3321 | 2 |
| R7 | 601-822299 | Resistor, F. Comp., 6.8K, 1/4W, 5% | Allen Bradley CB6825 | 1 |
| R9, 13 | 601-823937 | Resistor, F. Comp., 680Ω, 1/4W, 10% | Allen Bradley CB6811 | 2 |
| R14 | 601-823942 | Resistor, F. Comp., 3.3K, 1/4W, 10% | Allen Bradley CB3321 | 1 |
| R21 | 601-822328 | Resistor, F. Comp., 2.2K, 1/4W, 5% | Allen Bradley CB2225 | 1 |
| R22 | 601-822531 | Resistor, F. Comp., 33K, 1/4W, 5% | Allen Bradley CB3331 | 1 |
| R24 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 1 |
| R25 | 601-823941 | Resistor, F. Comp., 2.7K, 1/4W, 10% | Allen Bradley CB2721 | 1 |
| R27 | 601-823925 | Resistor, F. Comp., 47Ω, 1/4W, 10% | Allen Bradley CB4701 | 1 |
| R29 | 601-822370 | Resistor, F. Comp., 510Ω, 1/4W, 5% | Allen Bradley CB4115 | 1 |
| R30 | 601-079172 | Resistor, F. Comp., 820Ω, 1/2W, 5% | Allen Bradley EB8215 | 1 |
| R31 | 601-822301 | Resistor, F. Comp., 15K, 1/4W, 5% | Allen Bradley CB1535 | 1 |
| | 864-412958 | Pad, Transistor | Beckman | 3 |




NOTE:

1) RESISTORS:
   WATTAGE —— 1/4W, UNLESS NOTED.
   TOLERANCE —— 10%, " "
2) CAPACITORS:
   CAPACITY —— IN pf, " "
   VOLTAGE —— 300v, " "
   TOLERANCE —— 5%, " "
3) .01µf DISC ARE -20+80%, 500v.
4) DIODES:
   * PER BECKMAN SPEC. A755-431324.
   ** " " " A755-420893




1 MC OSCILLATOR AND SHAPER
COMPONENT LAYOUT (A43)

## 1 MC OSCILLATOR BOARD (A43)*

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty. / Ass'y |
|---|---|---|---|---|
| A43 | 887-411676 | 1 Mc Oscillator Board | Beckman | 1 |
| C1 | 631-814053 | Capacitor, F. Elect., 1μf, 35V, 20% | Sprague 150D105X0035A2 | 1 |
| C2 | 631-802980 | Capacitor, F. Elect., 22μf, 25V, 20% | Sprague 109D226X0025C2 | 1 |
| C3, 4 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 2 |
| C5 | 637-824018 | Capacitor, F. Mica, 150pf, 300V, 5% | Arco DM16E151J-300 | 1 |
| C6 | 637-824302 | Capacitor, F. Mica, 300pf, 300V, 5% | Arco DM16E301J-300 | 1 |
| C7 | 637-824028 | Capacitor, F. Mica, 1000pf, 300V, 5% | Arco DM16E102J-300 | 1 |
| C8, 11 | 637-824301 | Capacitor, F. Mica, 2000pf, 300V, 5% | Arco DM20F202-300 | 2 |
| C9, 10 | 637-824025 | Capacitor, F. Mica, 560pf, 300V, 5% | Arco DM16E561J-300 | 2 |
| C12 | 637-824303 | Capacitor, F. Mica, 3900pf, 300V, 5% | Arco DM20F392-300 | 1 |
| CR1 | 755-811280 | Diode, Reference, Sil., 5V min, 5.5V max. | Cont. Devic. CD3319 | 1 |
| CR2 | 755-402107 | Diode, Special | Beckman | 1 |
| L1 | 795-807904 | Inductor, Fixed, R. F., 0.100 mH | National RA-100-P | 1 |
| L2 | 795-827337 | Inductor, Fixed, R. F., 0.0068 mH | National NB6.8I | 1 |
| Q1, 2 | 755-817216 | Transistor, Germanium, PNP, 75mw max. | Philco 2N502A | 2 |
| Q3, 4 | 755-817811 | Transistor, Germanium, PNP, 150mw | Motorola 2N961 | 2 |
| Q5 | 755-823113 | Transistor, Silicon, NPN, 800mw max. | Motorola 2N2219 | 1 |
| R1 | 601-822327 | Resistor, F. Comp., 220Ω, 1/4W, 5% | Allen Bradley CB2215 | 1 |
| R2 | 601-015446 | Resistor, F. Comp., 470Ω, 1/2W, 5% | Allen Bradley EB4715 | 1 |
| R3, 9 | 601-822460 | Resistor, F. Comp., 3.9K, 1/4W, 5% | Allen Bradley CB3925 | 2 |
| R4 | 601-822299 | Resistor, F. Comp., 6.8K, 1/4W, 5% | Allen Bradley CB6825 | 1 |
| R5 | 601-801803 | Resistor, F. Comp., 12K, 1/4W, 5% | Allen Bradley CB1235 | 1 |
| R6, 8 | 601-822306 | Resistor, F. Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 2 |
| R7, 12 | 601-822295 | Resistor, F. Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 2 |

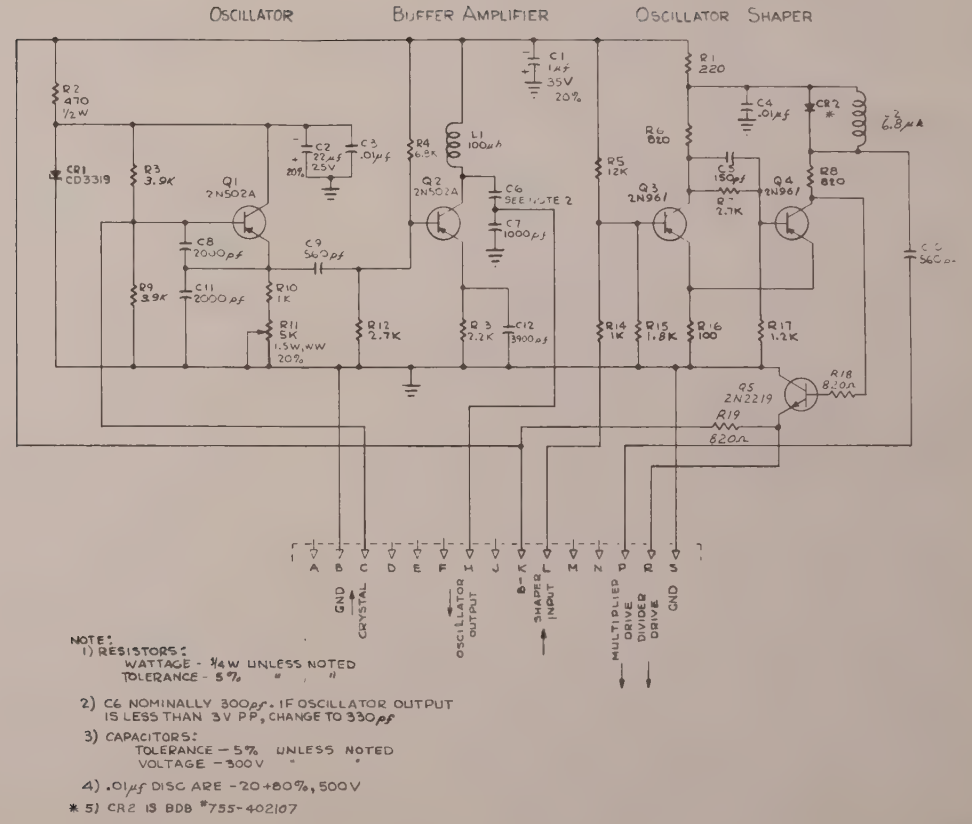
*See Outline Drawing (D415600) for associated parts.

. . . continued

## 1 MC OSCILLATOR BOARD (A43) - continued

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| R10, 14 | 601-822308 | Resistor, F. Comp., 1K, 1/4W, 5% | Allen Bradley CB1025 | 2 |
| R11 | 611-812859 | Resistor, V. WW, 5K, 1-1/2W, 20% | C. T. S. Series 111 | 1 |
| R13 | 601-822328 | Resistor, F. Comp., 2.2K, 1/4W, 5% | Allen Bradley CB2225 | 1 |
| R15 | 601-822544 | Resistor, F. Comp., 1.8K, 1/4W, 5% | Allen Bradley CB1825 | 1 |
| R16 | 601-817735 | Resistor, F. Comp., 100Ω, 1/4W, 5% | Allen Bradley CB1015 | 1 |
| R17 | 601-822326 | Resistor, F. Comp., 1.2K, 1/4W, 5% | Allen Bradley CB1225 | 1 |
| R18, 19 | 601-822306 | Resistor, F. Comp., 820Ω, 1/4W, 5% | Allen Bradley CB8215 | 2 |
| | 864-412958 | Pad, Convertor Transistor | Beckman | 5 |

## 1 MC OSCILLATOR AND SHAPER (A43) SCHEMATIC DIAGRAM




NOTE:
1) RESISTORS:
WATTAGE - 1/4W UNLESS NOTED
TOLERANCE - 5% " "

2) C6 NOMINALLY 300pf. IF OSCILLATOR OUTPUT IS LESS THAN 3V P-P, CHANGE TO 330pf

3) CAPACITORS:
TOLERANCE - 5% UNLESS NOTED
VOLTAGE - 300V "

4) .01µf DISC ARE -20+80%, 500V

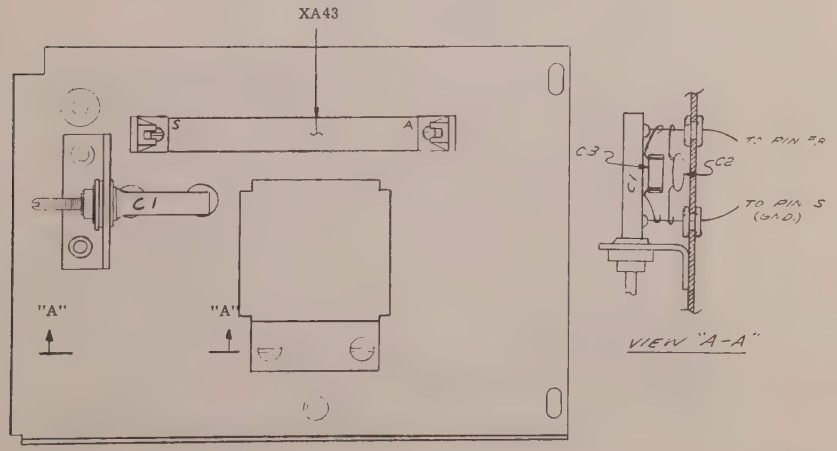
* 5) CR2 IS BDB #755-402107

Model 6144
C-411996 - Rev. C
MAY 3 1967

Beckman

## 1 MC OSCILLATOR ASSEMBLY (A38)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C1 | 655-415515 | Capacitor, V. Glass, 0.6-14pf, 1000V, -40 to +50 PPM/°C | J. F. D. Elect., VC11GRA (Mod) | 1 |
| C2 | xxx-xxxxxx | Factory selected value (normally 27pf, 10%, 600V) | Beckman | 1 |
| C3 | 633-827603 | Capacitor, F. Cerm., 3.3pf, T. C. -750 PPM/°C | Centralab TCN-3R3 | 1 |
| C5 | 639-835127 | Capacitor, F. Paper, 3μf, 50V, 10% | Elpac VX5A305K | 1 |
| J4 | 670-806738 | Connector, Coaxial, Receptacle, BNC Type | Amphenol UG-1094/U | 1 |
| L1, 2 | 795-807919 | Inductor, F. RF, 0.470μH, 9Ω, 285 MA | Delevan 3500-24 | 2 |
| R3 | 601-822371 | Resistor, F. Comp., 390Ω, 1/4W, 5% | Allen Bradley CB3915 | 1 |
| S6 | 716-827410 | Switch, Slide, DPDT | Continental Type 126 (C-W) | 1 |
| XA43 | 680-823481 | P. C. Connector, 15 Contacts | Cinch 250-15-70-170 | 1 |
| XY1 | 860-802333 | Socket, Tube, 8-Pin Saddle Mounting | Cinch 16203 (P/O 40-415714) | 1 |
| Y1 | 881-430340 | Crystal and Oven Assembly | Beckman | 1 |
| | 430-415711 | Chassis Oscillator | Beckman | 1 |
| | 864-415712 | Insulator, Oven Clamp Bracket | Beckman | 1 |

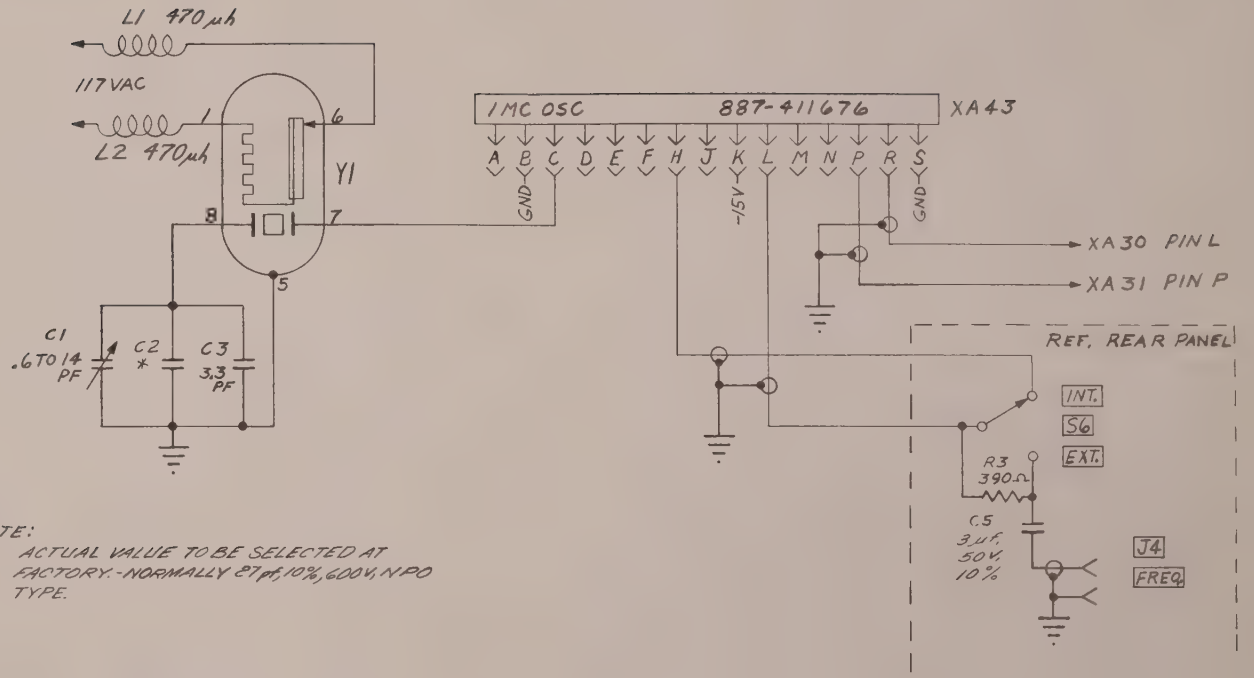






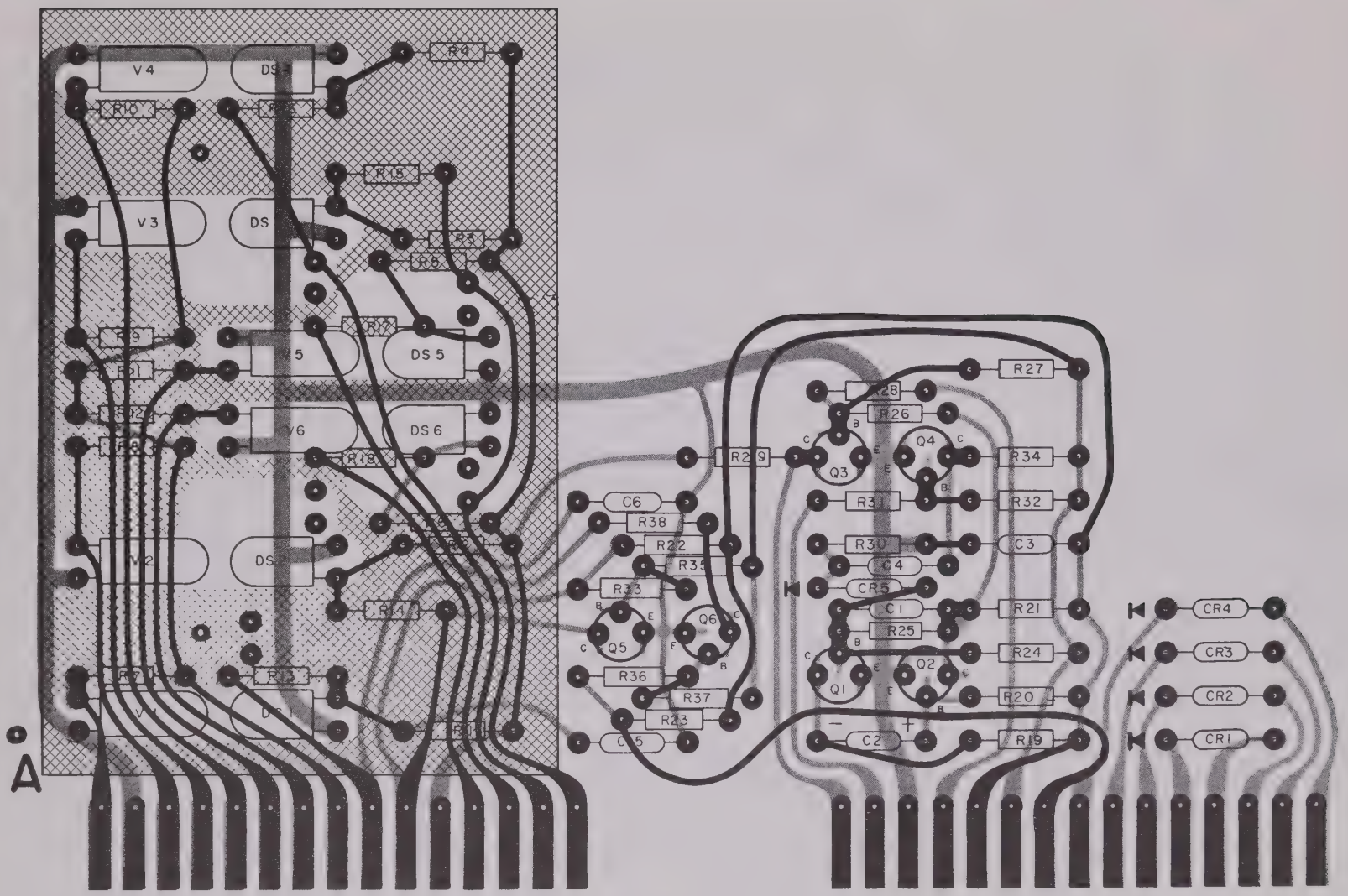
VIEW "A-A"

(C415715-C)




* NOTE:
ACTUAL VALUE TO BE SELECTED AT FACTORY.-NORMALLY 27pf, 10%, 600V, NPO TYPE.

Model 6144
811535 Rev. F
March 1967
Beckman




LEGEND COMPONENT LAYOUT (A32)

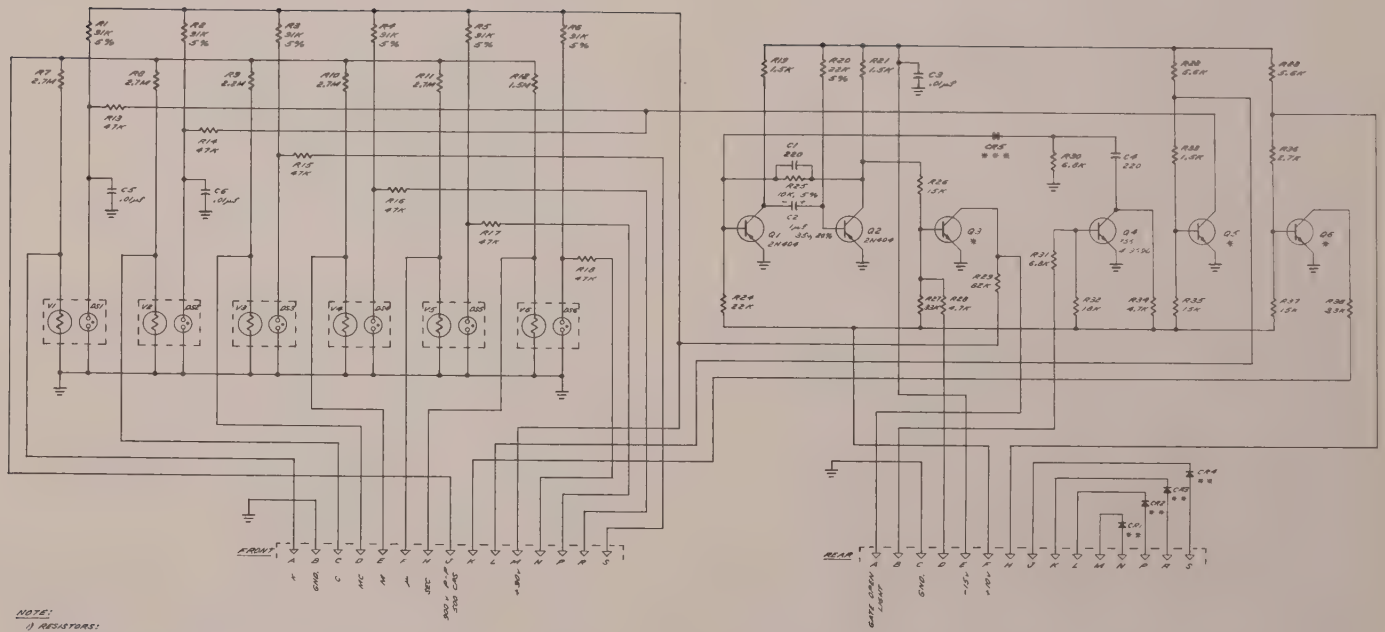


Model 6144
64C-6100-009-Rev. C
March 1967

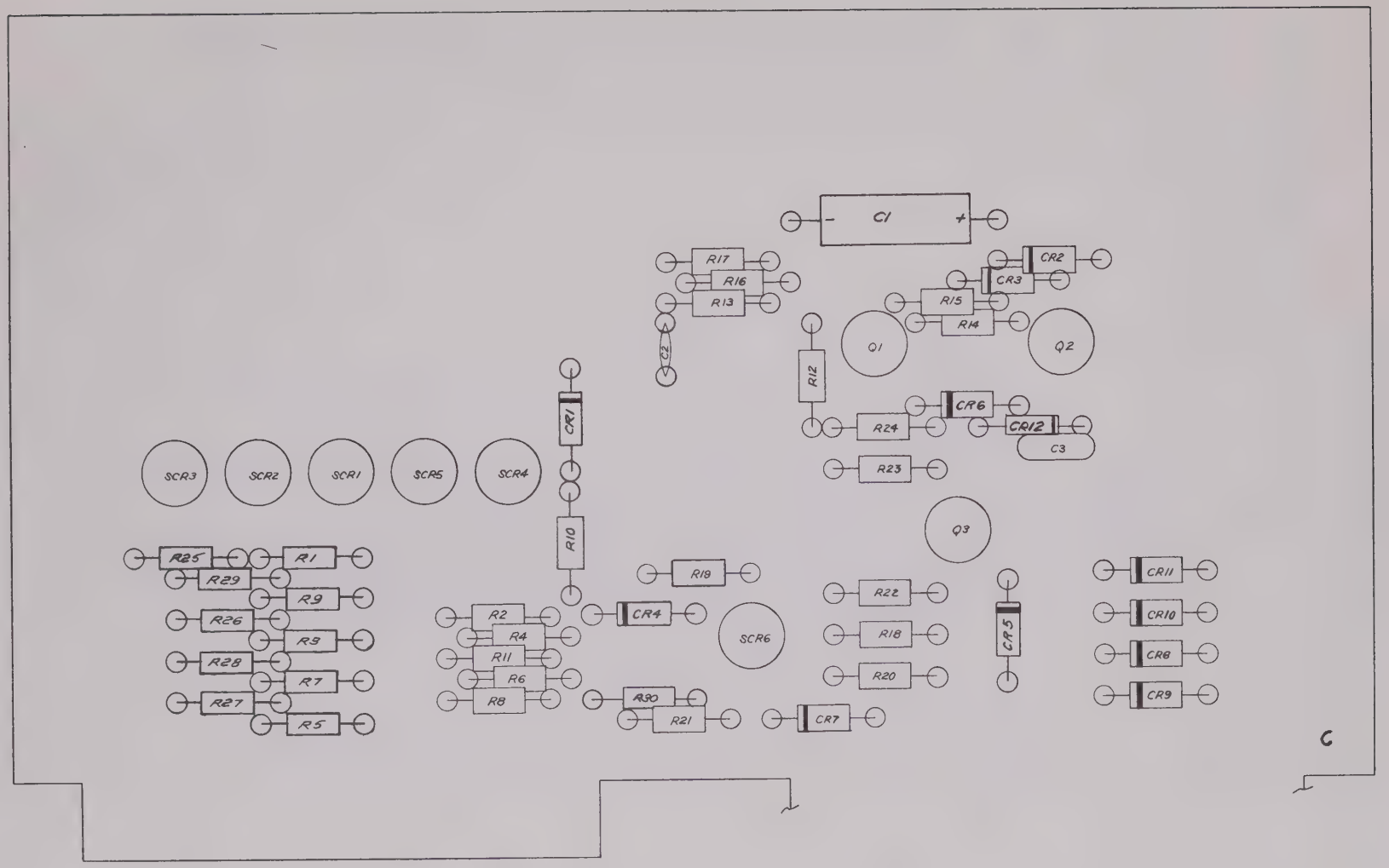
Beckman

## LEGEND BOARD (A32)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A32 | 887-418075 | Legend Board | Beckman | 1 |
| C1, 4 | 637-824020 | Capacitor, F. Mica, 220pf, 300V, 5% | Arco DM16E221J-300 | 2 |
| C2 | 631-814053 | Capacitor, F. Elect., 1μf, 35V, 20% | Sprague 150D105X0035A2 | 1 |
| C3, 5, 6 | 633-804717 | Capacitor, F. Cerm., 0.01μf, 500V | Sprague 29C9B5 | 3 |
| CR1, 2, 3, 4 | 755-815561 | Diode, Silicon, 75PIV, 10ma, 1V min. fwd. | Continental CD6111 | 4 |
| CR5 | 755-404593 | Diode, Special | Beckman | 1 |
| DS1, 2, 3, 4, 5, 6 | 825-414955 | Lamp, Neon, Special | Beckman | 6 |
| Q1, 2 | 755-800398 | Transistor, Germ., PNP, 150mw max. | Sylvania 2N404 | 2 |
| Q3, 5, 6 | 755-410066 | Transistor, Special | Beckman | 3 |
| Q4 | 755-419596 | Transistor, Special | Beckman | 1 |
| R1, 2, 3, 4, 5, 6 | 601-822337 | Resistor, F. Comp., 91K, 1/4W, 5% | Allen Bradley CB9135 | 6 |
| R7, 8, 10, 11 | 601-824112 | Resistor, F. Comp., 2.7M, 1/4W, 10% | Allen Bradley CB2751 | 4 |
| R9 | 601-824831 | Resistor, F. Comp., 2.2M, 1/4W, 10% | Allen Bradley CB2251 | 1 |
| R12 | 601-824832 | Resistor, F. Comp., 1.5M, 1/4W, 10% | Allen Bradley CB1551 | 1 |
| R13, 14, 15, 16, 17, 18 | 601-823951 | Resistor, F. Comp., 47K, 1/4W, 10% | Allen Bradley CB4731 | 6 |
| R19, 21, 33 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 3 |
| R20 | 601-822334 | Resistor, F. Comp., 22K, 1/4W, 5% | Allen Bradley CB2235 | 1 |
| R22, 23 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 10% | Allen Bradley CB5621 | 2 |
| R24 | 601-823110 | Resistor, F. Comp., 22K, 1/4W, 10% | Allen Bradley CB2231 | 1 |
| R25 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 1 |
| R26, 35, 37 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 3 |
| R27, 38 | 601-823109 | Resistor, F. Comp., 33K, 1/4W, 10% | Allen Bradley CB3331 | 2 |
| R28, 34 | 601-815239 | Resistor, F. Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 2 |
| R29 | 601-823954 | Resistor, F. Comp., 82K, 1/4W, 10% | Allen Bradley CB8231 | 1 |
| R30, 31 | 601-823945 | Resistor, F. Comp., 6.8K, 1/4W, 10% | Allen Bradley CB6821 | 2 |
| R32 | 601-823948 | Resistor, F. Comp., 18K, 1/4W, 10% | Allen Bradley CB1831 | 1 |
| R36 | 601-822295 | Resistor, F. Comp., 2.7K, 1/4W, 5% | Allen Bradley CB2725 | 1 |
| V1, 2, 3, 4, 5, 6 | 753-416278 | Photo-Resistor, End-View, Special | Beckman | 6 |
| | 864-412958 | Pad, Transistor | Beckman | 6 |
| | 824-414475 | Lamp, Block, Cover | Beckman | 1 |
| | 824-412922 | Lamp, Block, Base | Beckman | 1 |




NOTE:
1) RESISTORS:
WATTAGE —— ¼W., UNLESS NOTED.
TOLERANCE —— 10% " " ,
2) CAPACITORS:
CAPACITY —— 1M PF., " " ,
VOLTAGE —— 200 V. " " ,
TOLERANCE —— 5% " " ,
3) .01μF DISC ARE -80+80%, 500 V.
4) ALL MRAM BUILDS ARE TO BECKMAN SPEC. DWG. A08S-4148355. (DS1 THRU DS8)
5) ALL PHOTORESISTORS ARE TO BECKMAN SPEC. DWG. A753-4165570. (V1 THRU V8)
6) * — TRANSISTORS ARE TO BECKMAN SPEC. DWG. A755-4100268.
7) * * — DIODES ARE TO BECKMAN SPEC. PART NO 755-8155361. (CR6!!)
8) * * * — DIODES TO BECKMAN SPEC. DWG. NO A755-4164133.




LEGEND COMPONENT LAYOUT (A32)

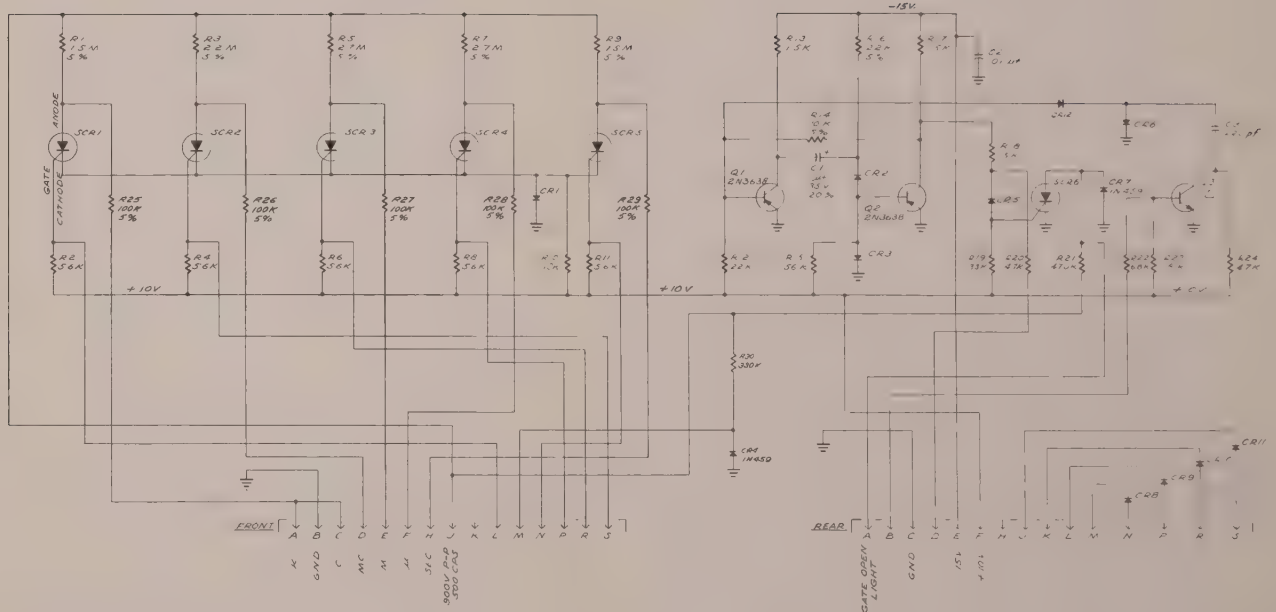


Model 6144
C431226 - Rev. E
March 1967

Beckman®

## LEGEND BOARD (A32)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A32 | 887-431226 | Legend Board | Beckman | 1 |
| C1 | 631-802881 | Capacitor, F. Elect., 1μf, 25V | Sprague 30D105G025BA2 | 1 |
| C2 | 633-804715 | Capacitor, F. Cerm., 0.01μf, 50V | Sprague 19C214 | 1 |
| C3 | 637-822986 | Capacitor, D. Mica, 220pf, 500V, 5% | Electromotive DM15F221J0-500WV4CR | 1 |
| CR1, 2, 3, 5, 6, 8, 9, 10, 11, 12 | 755-431324 | Diode, Special | Beckman | 10 |
| CR4, 7 | 755-814091 | Diode, Type 1N459 | Texas Instruments | 2 |
| Q1, 2 | 755-838105 | Transistor, Type 2N3638 | Fairchild | 2 |
| Q3 | 755-419596 | Transistor, Special | Beckman | 1 |
| R1, 9 | 601-825378 | Resistor, F. Comp., 1.5M, 1/4W, 5% | Allen Bradley CB1555 | 2 |
| R2, 4, 6, 8, 11 | 601-823944 | Resistor, F. Comp., 5.6K, 1/4W, 10% | Allen Bradley CB5621 | 5 |
| R3 | 601-819691 | Resistor, F. Comp., 2.2M, 1/4W, 5% | Allen Bradley CB2255 | 1 |
| R5, 7 | 601-819693 | Resistor, F. Comp., 2.7M, 1/4W, 5% | Allen Bradley CB2755 | 2 |
| R10, 14 | 601-822324 | Resistor, F. Comp., 10K, 1/4W, 5% | Allen Bradley CB1035 | 2 |
| R12, 16 | 601-822334 | Resistor, F. Comp., 22K, 1/4W, 5% | Allen Bradley CB2235 | 2 |
| R13, 17 | 601-823112 | Resistor, F. Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 2 |
| R15 | 601-823952 | Resistor, F. Comp., 56K, 1/4W, 10% | Allen Bradley CB5631 | 1 |
| R18 | 601-823107 | Resistor, F. Comp., 15K, 1/4W, 10% | Allen Bradley CB1531 | 1 |
| R19 | 601-823109 | Resistor, F. Comp., 33K, 1/4W, 10% | Allen Bradley CB3331 | 1 |
| R20 | 601-815239 | Resistor, F. Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 1 |
| R21, 24 | 601-823961 | Resistor, F. Comp., 470K, 1/4W, 10% | Allen Bradley CB4741 | 2 |
| R22 | 601-823945 | Resistor, F. Comp., 6.8K, 1/4W, 10% | Allen Bradley CB6821 | 1 |
| R23 | 601-823948 | Resistor, F. Comp., 18K, 1/4W, 10% | Allen Bradley CB1831 | 1 |
| R25, 26, 27, 28, 29 | 601-823904 | Resistor, F. Comp., 100K, 1/4W, 5% | Allen Bradley CB1045 | 5 |
| R30 | 601-823910 | Resistor, F. Comp., 330K, 1/4W, 5% | Allen Bradley CB3345 | 1 |
| SCR1, 2, 3, 4, 5, 6 | 755-431528 | Silicon Controlled Rectifier | Beckman | 6 |
| | 864-412958 | Transistor Pad | Beckman | 7 |

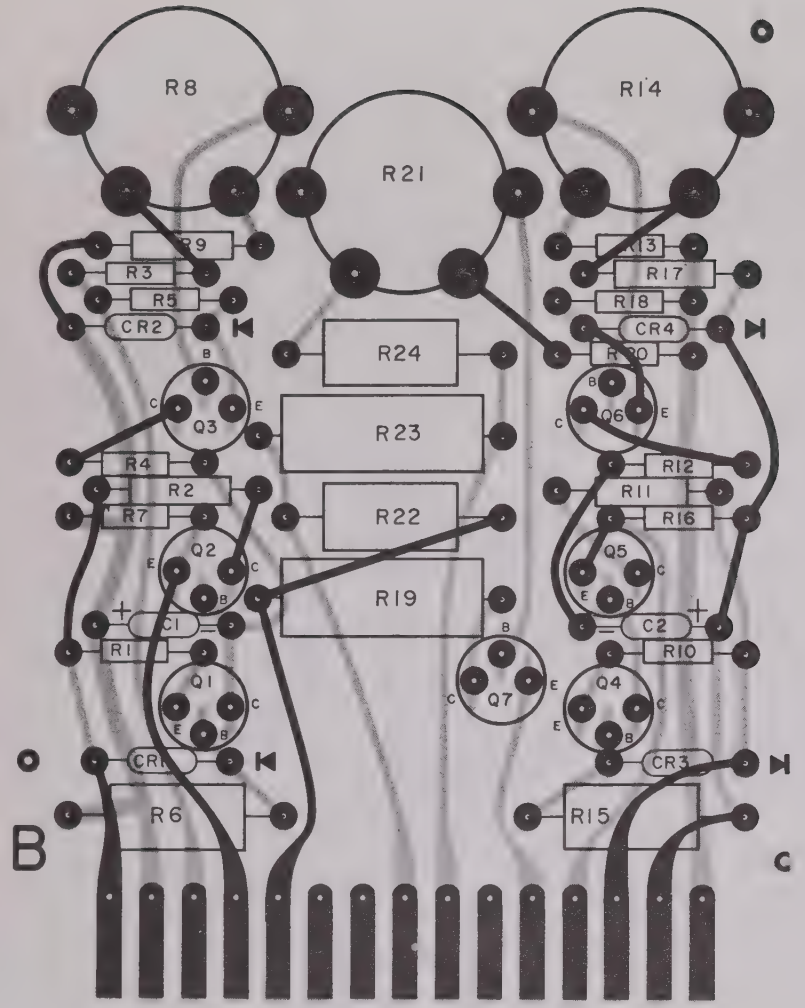



NOTES:

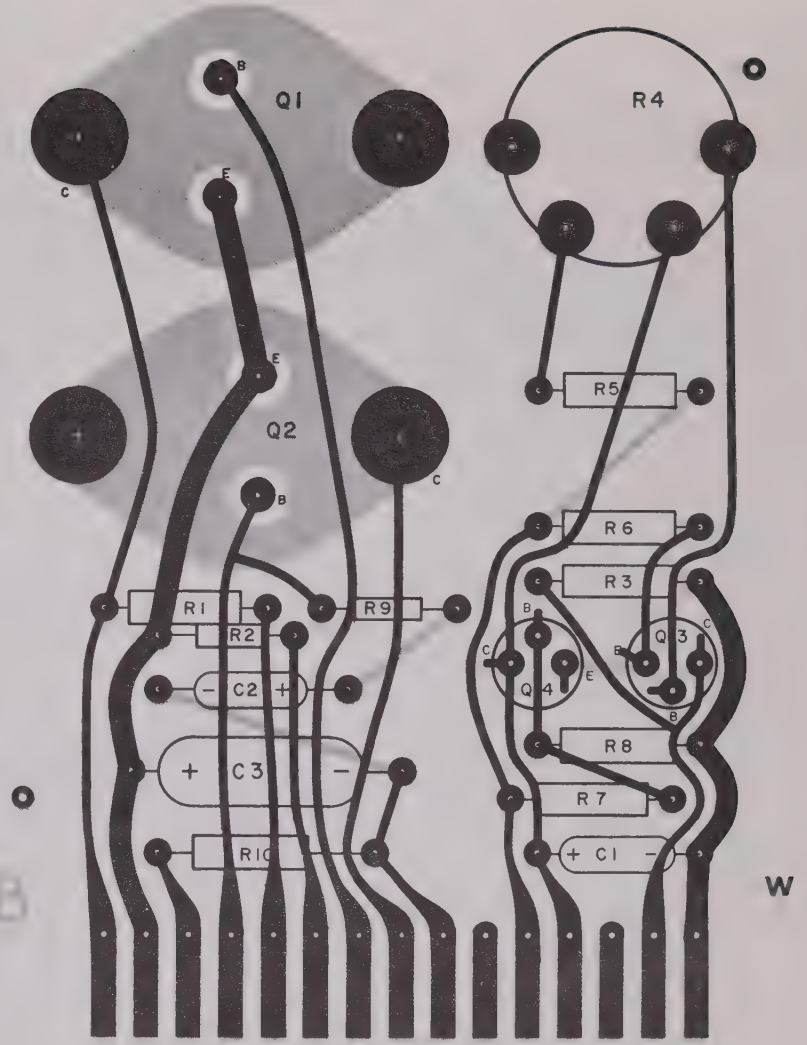
1. RESISTORS: 1/8 W, 10% EXCEPT AS NOTED.
2. DIODES: PER BECKMAN SPEC. A755-43/324 EXCEPT AS NOTED
3. TRANSISTORS'

△ ARE PER BECKMAN SPEC. A755-4/8596

4. SCR'S ARE PER BECKMAN SPEC. A755-43/528.




Regulator




EL Supply

POWER SUPPLY COMPONENT LAYOUTS (A34 & A35)



Beckman
Model 6144
643-6100-021-Rev. L
March 1967

Beckman
Model 6144
643-6100-022-Rev. L
March 1967

## REGULATOR BOARD (A34)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A34 | 887-412442 | Regulator Board | Beckman | 1 |
| C1, 2 | 631-814053 | Capacitor, F.Elect., 1μf, 33V, 20% | Sprague 150D105X0035A2 | 2 |
| CR1, 3 | 755-404593 | Diode, Silicon, Special | Beckman | 2 |
| CR2, 4 | 755-814019 | Diode, Zener, 400mw | Motorola 1N754A | 2 |
| Q1, 4 | 755-811274 | Transistor, Type 2N445A | Gen. Trans. 2N445A | 2 |
| Q2, 3, 5, 6 | 755-838105 | Transistor, Type 2N3638 | Fairchild, Type 2N3638 | 4 |
| Q7 | 755-415078 | Transistor, Special | Beckman | 1 |
| R1, 10 | 601-823934 | Resistor, F.Comp., 270Ω, 1/4W, 10% | Allen Bradley CB2711 | 2 |
| R2 | 601-008065 | Resistor, F.Comp., 100Ω, 1/2W, 10% | Allen Bradley EB1011 | 1 |
| R3, 13 | 601-823104 | Resistor, F.Comp., 390Ω, 1/4W, 10% | Allen Bradley CB3911 | 2 |
| R4, 12 | 601-823105 | Resistor, F.Comp., 470Ω, 1/4W, 10% | Allen Bradley CB4711 | 2 |
| R5 | 601-823112 | Resistor, F.Comp., 1.5K, 1/4W, 10% | Allen Bradley CB1521 | 1 |
| R6, 15 | 601-008059 | Resistor, F.Comp., 2.2K, 1W, 10% | Allen Bradley GB2221 | 2 |
| R7, 16 | 601-815239 | Resistor, F.Comp., 4.7K, 1/4W, 10% | Allen Bradley CB4721 | 2 |
| R8, 14 | 611-812861 | Resistor, V. WW, 200Ω, 1.5W, 20% | C.T.S. Series 111 | 2 |
| R9, 17 | 601-008071 | Resistor, F.Comp., 330Ω, 1/2W, 10% | Allen Bradley EB3311 | 2 |
| R11 | 601-008068 | Resistor, F.Comp., 180Ω, 1/2W, 10% | Allen Bradley EB1811 | 1 |
| R18 | 601-812856 | Resistor, F.Comp., 2.2K, 1/4W, 10% | Allen Bradley CB2221 | 1 |
| R19 | 601-800143 | Resistor, F.Comp., 3.3K, 2W, 5% | Allen Bradley EB3325 | 1 |
| R20 | 601-822296 | Resistor, F.Comp., 3.3K, 1/4W, 5% | Allen Bradley CB3321 | 1 |
| R21 | 601-812860 | Resistor, Var., WW, 2000Ω, 1.5W, 20% | Chicago Tel. Series 111 | 1 |
| R22 | 601-016229 | Resistor, F.Comp., 1.5K, 1W, 5% | Allen Bradley GB1525 | 1 |
| R23 | 601-800132 | Resistor, F.Comp., 680Ω, 2W, 5% | Allen Bradley GB6811 | 1 |
| R24 | 601-043215 | Resistor, F.Comp., 18K, 1W, 5% | Allen Bradley GB1835 | 1 |
| | 864-412958 | Pad, Transistor | Beckman | 6 |

## EL SUPPLY BOARD (A35)

| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| A35 | 887-412795 | EL Supply Board | Beckman | 1 |
| C1 | 631-824631 | Capacitor, F.Elect., 10μf, 20V, 20% | Fansteel STA-621-1 | 1 |
| C2 | 631-802980 | Capacitor, F.Elect., 22μf, 25V, 20% | Sprague 109D226X0025C2 | 1 |
| C3 | 631-841374 | Capacitor, F.Elect., 150μf, 20V, 10% | Mallory MTP157K020 | 1 |

. . . continued

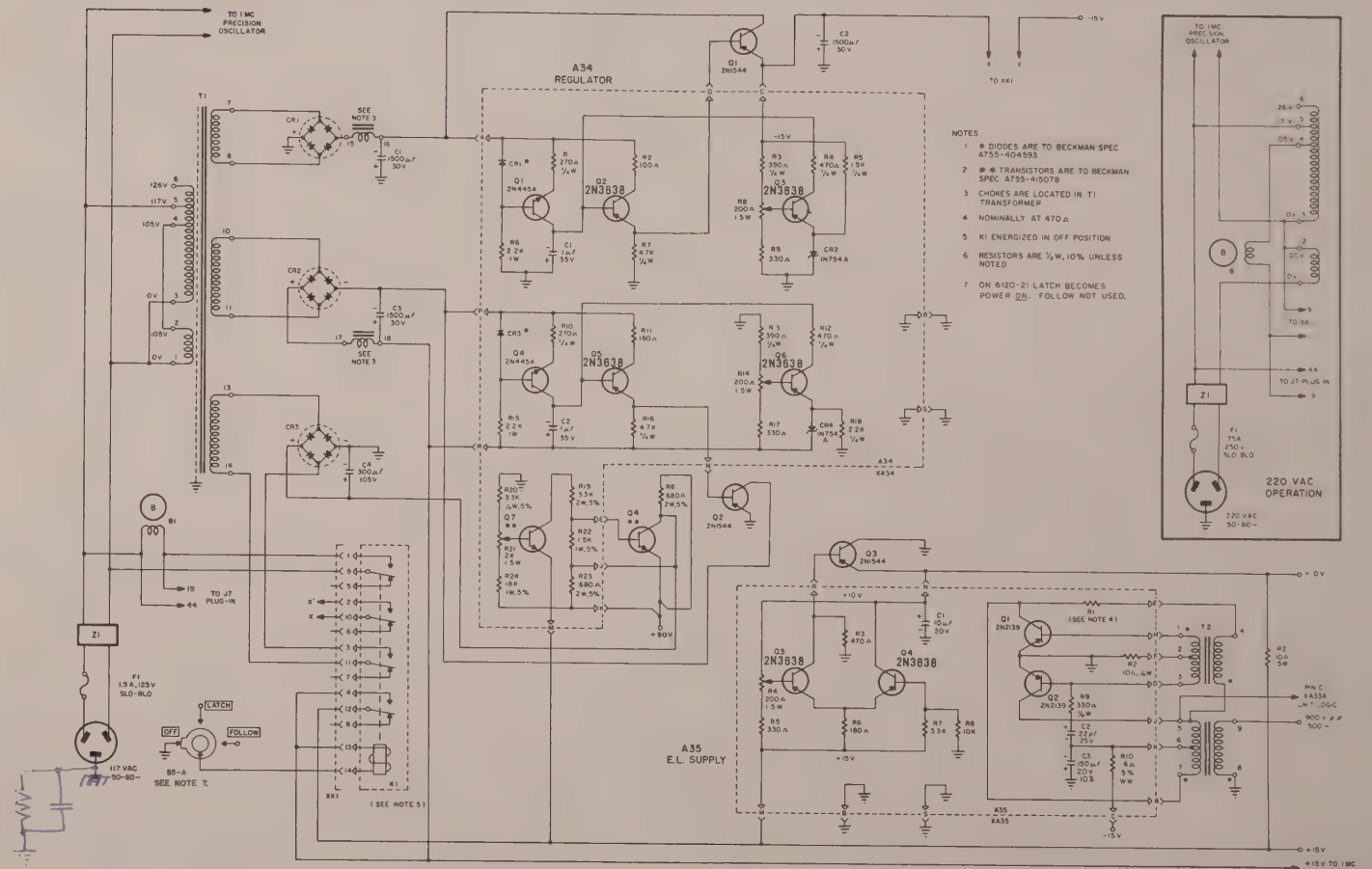
EL SUPPLY BOARD (A35) - continued

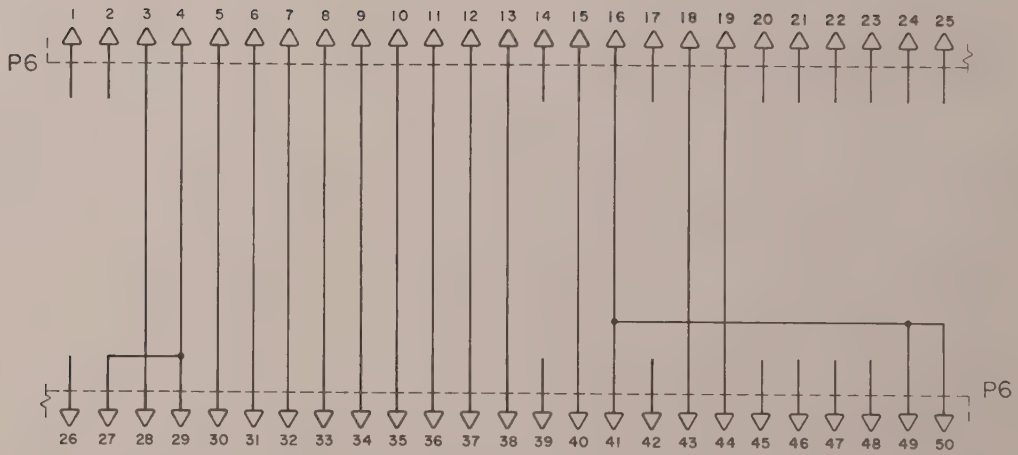
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| Q1, 2 | 755-824875 | Transistor, Germ., PNP, 63W | Motorola 2N2139 | 2 |
| Q3, 4 | 755-838105 | Transistor, Type 2N3638 | Fairchild, Type 2N3638 | 2 |
| R1, 3 | 601-800031 | Resistor, F. Comp., 470Ω, 1/2W, 10% | Allen Bradley EB4711 | 2 |
| R2 | 601-823917 | Resistor, F. Comp., 10Ω, 1/4W, 10% | Allen Bradley CB1001 | 1 |
| R4 | 611-812861 | Resistor, V. WW, 200Ω, 1.5W, 20% | C.T.S. Series 111 | 1 |
| R5 | 601-008071 | Resistor, F. Comp., 330Ω, 1/2W, 10% | Allen Bradley EB3311 | 1 |
| R6 | 601-008068 | Resistor, F. Comp., 180Ω, 1/2W, 10% | Allen Bradley EB1811 | 1 |
| R7 | 601-010684 | Resistor, F. Comp., 3.3K 1/2W, 10% | Allen Bradley EB3321 | 1 |
| R8 | 601-007932 | Resistor, F. Comp., 10K, 1/2W, 10% | Allen Bradley EB1031 | 1 |
| R9 | 601-823935 | Resistor, F. Comp., 330Ω, 1/4W, 10% | Allen Bradley CB3311 | 1 |
| R10 | 604-817358 | Resistor, F. WW, 1.5Ω, 1/2W, 5% | I.R.C. BW | 1 |
| | 864-412958 | Pad, Transistor | Beckman | 2 |

MISCELLANEOUS PARTS
(Power Supply)

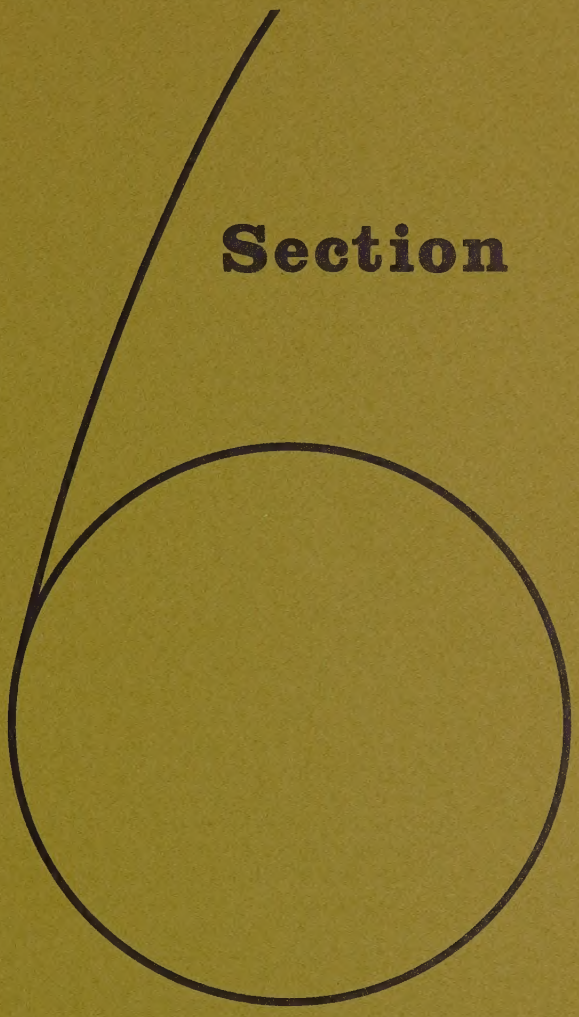
| Detail No. | Beckman Stock No. | Description | Typical Manufacturer & No. | Qty./ Ass'y |
|---|---|---|---|---|
| C1, 2, 3 | 631-412828 | Capacitor, F. Elect., 1500μf, 30V | Beckman | 3 |
| C4 | 631-410854 | Capacitor, F. Elect., 300μf, 150V | Beckman | 1 |
| CR1 | 774-824971 | Rectifier Bridge, 3 amps | Semtech SA780 | 1 |
| CR2, 3 | 774-824972 | Rectifier Bridge, 1.5 amps | Semtech SCBR2 | 2 |
| F1 | 731-801567 | Fuse, Electrical, 1.5 amp, at 125V T.D. | Littelfuse 31301.5 | 1 |
| K1 | 718-827701 | Relay, 12V, 4Form C | Potter-Brum. KHP 17D12 | 1 |
| Q1, 2, 3 | 755-822107 | Transistor, Germ., PNP, 2ma max. | Motorola 2N1544 | 3 |
| Q4 | 755-415078 | Transistor, Special | Beckman | 1 |
| R2 | 604-801990 | Resistor, F. WW, 10Ω, 5W, 10% | Tru-Ohm FRL-5-10-10% | 1 |
| R8 | 601-800132 | Resistor, F. Comp., 680Ω, 2W, 5% | Allen Bradley HB6815 | 1 |
| T1 | 792-411294 | Transformer, Power | Beckman | 1 |
| T2 | 792-411415 | Transformer, EL | Beckman | 1 |
| XF1 | 735-007268 | Fuseholder, 15 amp at 250V breakdown | Bussman HKP | 1 |
| XK1 | 860-824956 | Socket, Relay | Potter-Brum. 27E008 | 1 |
| Z1 | 771-416479 | Filter, Interference | Beckman | 1 |

POWER SUPPLY (A34 & A35)
SCHEMATIC DIAGRAM


A34
REGULATOR
A35
E.L. SUPPLY
220 VAC
OPERATION
NOTES
1 ⊛ DIODES ARE TO BECKMAN SPEC A755-404593
2 ⊛⊛ TRANSISTORS ARE TO BECKMAN SPEC A755-415078
3 CHOKES ARE LOCATED IN T1 TRANSFORMER
4 NOMINALLY AT 470Δ
5 K1 ENERGIZED IN OFF POSITION
6 RESISTORS ARE ½W, 10% UNLESS NOTED
7 ON 6120-21 LATCH BECOMES POWER ON. FOLLOW NOT USED.


P6
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
P6
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

# Section



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